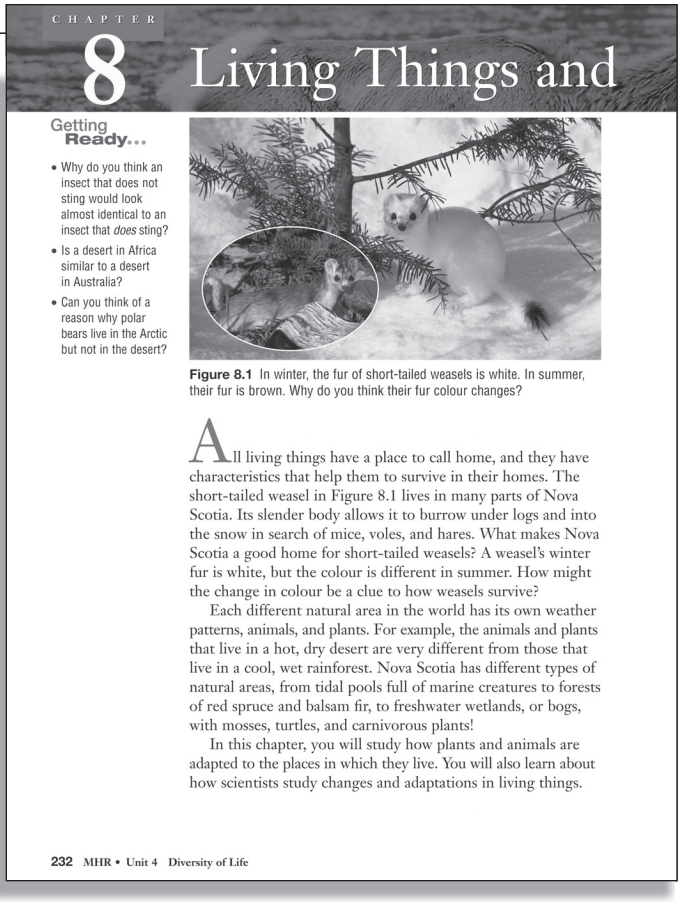
USING THE CHAPTER 8 OPENER

TEACHING STRATEGIES

- Ask students why they think certain plants and animals live where they do and what factors affect their survival. Suggest they write their ideas in their logbooks.
- The following examples could be used:
  - Rabbits prefer thick forest and thick bush that supplies food and slows down predators. Like short-tailed weasels, rabbits are white in winter and brown in summer to blend into their surroundings. Large feet transport them through the deep snow.
  - Eagles prefer living near rivers and estuaries (where rivers meet the ocean). There is a consistent supply of fish; the tall trees on the bank make hunting easy and are a safe place for nests.
  - The trees in Nova Scotia can survive harsh winters. Deciduous (hardwood) trees often lose their leaves in fall, conserving stored food and preventing water loss. They have thick bark; a deep tap root can resist strong winds and access water. Many coniferous (softwood) trees have tiny needles that stay during the winter. The small surface area of the needles prevents moisture loss but can create food for the tree when conditions are right.
- Or, use the *Getting Ready* questions and the question in the caption on page 232 of the student textbook to discuss how plant or animal habitats affect the appearance and behaviour of organisms.
- As a class, create a mind map to organize the students' thoughts and ideas about the word "adaptation," or ask students to begin one in their science logbooks.
- Read and discuss *What You Will Learn*, *Why It Is Important*, and *Skills You Will Use*. Encourage students to think about new ideas they expect to learn in this chapter.

Getting Ready Answers

- **Why do you think an insect that does not sting looks almost identical to an insect that *does* sting?** Its appearance confuses its predators. Predators are afraid of the insect that does sting and will avoid the imitator.
- **Is a desert in Africa similar to a desert in Australia?** Deserts in Africa and Australia are very similar. These locations have similar ranges in temperature and similar amounts of precipitation. Some plants and animals are specific to certain deserts, but most desert organisms survive the environment in similar ways.



CHAPTER 8 Living Things and

Getting Ready...

- Why do you think an insect that does not sting would look almost identical to an insect that *does* sting?
- Is a desert in Africa similar to a desert in Australia?
- Can you think of a reason why polar bears live in the Arctic but not in the desert?

Figure 8.1 In winter, the fur of short-tailed weasels is white. In summer, their fur is brown. Why do you think their fur colour changes?

All living things have a place to call home, and they have characteristics that help them to survive in their homes. The short-tailed weasel in Figure 8.1 lives in many parts of Nova Scotia. Its slender body allows it to burrow under logs and into the snow in search of mice, voles, and hares. What makes Nova Scotia a good home for short-tailed weasels? A weasel's winter fur is white, but the colour is different in summer. How might the change in colour be a clue to how weasels survive?

Each different natural area in the world has its own weather patterns, animals, and plants. For example, the animals and plants that live in a hot, dry desert are very different from those that live in a cool, wet rainforest. Nova Scotia has different types of natural areas, from tidal pools full of marine creatures to forests of red spruce and balsam fir, to freshwater wetlands, or bogs, with mosses, turtles, and carnivorous plants!

In this chapter, you will study how plants and animals are adapted to the places in which they live. You will also learn about how scientists study changes and adaptations in living things.

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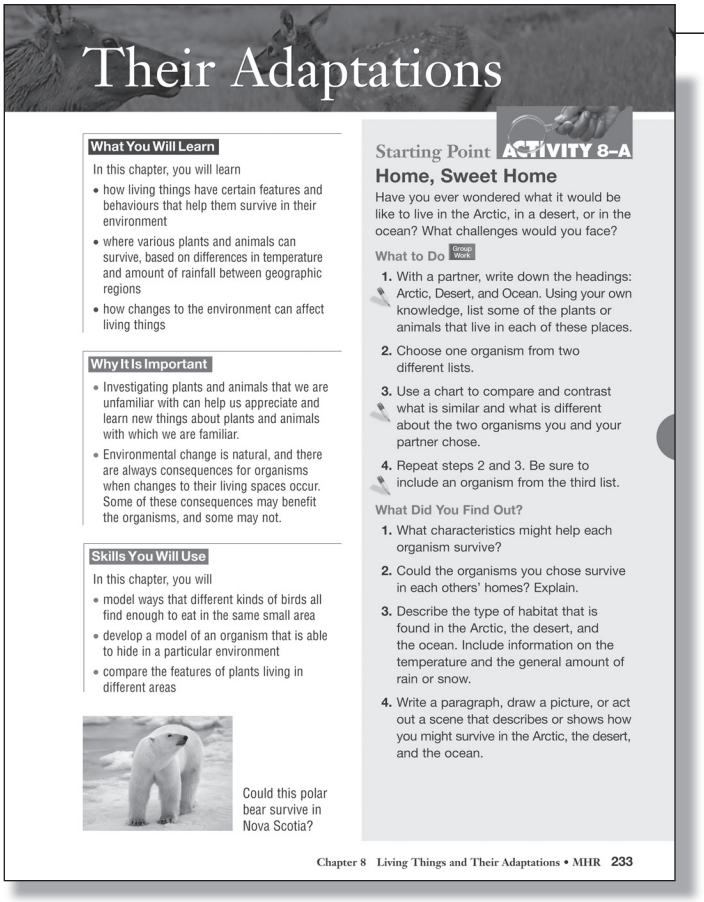
- **Can you think of a reason why polar bears live in the Arctic but not in the desert?** The polar bears' layers of fat and hair protect them in the colder climate but would be much too hot in most deserts. (Note: Parts of the Arctic are considered to be desert because they receive so little annual precipitation.)

Figure 8.1

- The short-tailed weasel, or ermine (*Mustela erminea*), is common across Nova Scotia, especially in forested areas. In summer, the upper parts of its coat are dark brown, and the head and legs are darker still. Between October and December, the pelt changes to white with a yellow tinge on the back. The last third of the tail is black year-round. Between March and April, the white fur changes to brown. This colour change is a form of camouflage. In winter or summer, the weasel can hide from predators and sneak up on prey such as mice, rabbits, and chipmunks.



Their Adaptations

What You Will Learn

In this chapter, you will learn

- how living things have certain features and behaviours that help them survive in their environment
- where various plants and animals can survive, based on differences in temperature and amount of rainfall between geographic regions
- how changes to the environment can affect living things

Why It Is Important

- Investigating plants and animals that we are unfamiliar with can help us appreciate and learn new things about plants and animals with which we are familiar.
- Environmental change is natural, and there are always consequences for organisms when changes to their living spaces occur. Some of these consequences may benefit the organisms, and some may not.

Skills You Will Use

In this chapter, you will

- model ways that different kinds of birds all find enough to eat in the same small area
- develop a model of an organism that is able to hide in a particular environment
- compare the features of plants living in different areas

Could this polar bear survive in Nova Scotia?

Starting Point ACTIVITY 8–A

Home, Sweet Home

Have you ever wondered what it would be like to live in the Arctic, in a desert, or in the ocean? What challenges would you face?

What to Do Group Work

1. With a partner, write down the headings: Arctic, Desert, and Ocean. Using your own knowledge, list some of the plants or animals that live in each of these places.
2. Choose one organism from two different lists.
3. Use a chart to compare and contrast what is similar and what is different about the two organisms you and your partner chose.
4. Repeat steps 2 and 3. Be sure to include an organism from the third list.

What Did You Find Out?

1. What characteristics might help each organism survive?
2. Could the organisms you chose survive in each others' homes? Explain.
3. Describe the type of habitat that is found in the Arctic, the desert, and the ocean. Include information on the temperature and the general amount of rain or snow.
4. Write a paragraph, draw a picture, or act out a scene that describes or shows how you might survive in the Arctic, the desert, and the ocean.

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STARTING POINT ACTIVITY 8-A HOME, SWEET HOME

Purpose

- Students compare and contrast organisms that live in the Arctic, in a desert, and in the ocean.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
3 to 4 weeks before	– Locate video or digital resources that introduce the desert, Arctic, and ocean environments.

MATERIALS
– chart paper and markers

Suggested Time

- 40–60 min

HINTS & TIPS

- Ask the librarian for resources on the three habitats and/or bookmark relevant web sites. To save time, assign a specific habitat to each person on the team.
- The idea is to introduce the idea that each plant or animal lives in a specific habitat, not to create an exhaustive list. Use a timer to limit the amount of time that students have to make their chart.

Implementing the Activity

- Begin by showing a video or digital presentation that gives your students a quick overview of diverse habitats and the plants and animals that live in them.
- Group your students into teams of three.

Adaptation

- In a mixed class, make sure there is wide representation of ethnicities in each team. Students who have lived in other countries will be able to share their knowledge of different habitats and environments.

Activity Wrap-Up

- Have your students complete *What Did You Find Out?* question 4.
- Discuss how moving a plant or animal from one place to another would affect it.

What Did You Find Out? Answers

1. Students should be able to name some physical characteristics and some behavioural characteristics. Accept any reasonable answer.
2. No. Plants and animals are adapted to a specific habitat. They might not survive in each other's homes because of differences in temperature, amount of precipitation, and types of food available. Sea life cannot survive in the desert, and desert animals cannot bury themselves in the snow and keep warm.
3. In general terms, the Arctic is very cold, has strong, dry winds, and receives very little precipitation. Deserts have very little precipitation, can be very hot in the daytime and cold at night, and some are covered in snow and ice year-round. Oceans are salt-water environments. They range in depth from very shallow to very deep so water temperatures range from warmer on the surface to colder at greater depths.
4. Answers should address key characteristics of each environment.

SECTION 8.1 ADAPTATIONS

What Students Do in Section 8.1

- investigate physical adaptations such as camouflage and mimicry
- compare different tools and bird beaks, and predict how the shape of a bird's beak influences what it eats
- investigate behavioural adaptations such as hibernation and migration
- design and create a model of an organism that is camouflaged in a particular environment

BACKGROUND INFORMATION

- A characteristic is a structure, behaviour, or ability that distinguishes an individual organism or group of organisms (a species) from others. This characteristic represents either a physical or behavioural adaptation.
- Generalists (for example, humans and rats) are organisms with adaptations that allow them to live in a variety of habitats and use different food sources. Specialists (for example, mountain goats and pandas) are organisms that are adapted to particular habitats and food requirements.
- Adaptations are the result of a gradual change in the characteristics of members of a population *over time*—usually generations. A variation—a visible or invisible difference—that helps an individual in a population survive and reproduce is likely to be passed on from survivor to survivor. Through generations of survivors, this variation will become more common, perhaps so common that it is considered to be a characteristic of that population.
  - Not all variations become adaptations. A variation in an individual can be an advantage or disadvantage or have no effect on the individuals as they live and interact in their environment.
- Inherited characteristics are passed from parents to the offspring via genes. The genes are in the reproductive cells that the parents produce. During reproduction, characteristics from both parents are passed on to the offspring. Since characteristics are inherited, the adaptation can be inherited.
- Offspring are not completely identical to their parents. For example, by chance, a chick hatches that has a thicker bill than that of its parents. It is able to crush more seeds and therefore get more food. It lives longer and has more offspring who may then pass the thicker bill on to their many offspring, and so the new physical characteristic successfully spreads in the population.

CHAPTER 8

Section 8.1 **Adaptations**

Key Terms
adaptations
physical adaptations
camouflage
mimicry
behavioural adaptations
hibernation
migration

Plants and animals are constantly challenged by the world around them. When they are hunting, searching for food, or even sleeping, they are challenged by other organisms or by hostile environmental conditions. They may also have difficulty finding food or mates. In order to survive, organisms have developed special protective characteristics over time. These characteristics are known as adaptations.

Adaptations are features that make an organism well-suited to its surroundings. They may be physical characteristics that affect structure or appearance, or behavioural characteristics that affect the way an organism acts. They give an organism a better chance of surviving and reproducing in a particular environment. It is important to note that adaptations are *inherited* characteristics. This means that they are passed on from one generation to the next. An organism already has all of its special adaptations when it is born.

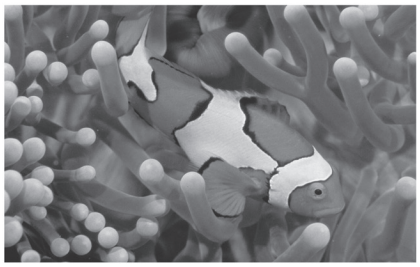

Figure 8.2 This clownfish is adapted to live among the tentacles of the sea anemone. The stinging tentacles of anemones do not harm clownfish. Since other fish avoid the tentacles, clownfish can live among anemones, safe from predators.

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TEACHING STRATEGIES

- Students familiar with the movie *Finding Nemo* will recognize the clownfish. Use Figure 8.2 to discuss the fact that the coloration of the clownfish, unlike that of the short-tailed weasel, does not help the organism hide. The clownfish has other adaptations that help it survive.

Common Misconceptions

- Some students may believe that only animals have adaptations that help them survive and reproduce in an environment. In reality, all living organisms have adaptations that allow them to survive and reproduce.
- Some students may believe that individual organisms can change in response to changing conditions. Adaptations happen over years and generations, which is why climate change can be a threat to a number of species.

Physical Adaptations

Adaptations that affect the way an organism looks are called **physical adaptations**. Physical adaptations include the structure of physical features, such as the long, pointy front teeth of a cat and the needle-like fur of a porcupine. Physical adaptations also include the colouring of skin, fur, and body coverings. You saw an example of this at the start of the chapter. The weasels in Figure 8.1 have white fur that blends in with the snow in winter, making it harder for their prey to see them. In spring, they grow a new, darker pelt. This is an inherited characteristic that helps the weasels survive.

You have physical adaptations as well. For example, your skin has sweat glands that help you keep a constant body temperature, no matter how hot or cold it is. When it is hot, sweat glands release water onto your skin. The water evaporates and, as a result, you become cooler. When it is cold, sweat glands do not release water, and you stay dry and warm. As you read more about adaptations in this section, see if you can think of how organisms you are familiar with are adapted to their unique surroundings.

Figure 8.3 There are dozens of ways in which living things are adapted to their surroundings. How many adaptations can you think of that help a beaver live and survive in and around streams and rivers?

READING Check

Is your sense of smell an adaptation that helps you survive? Explain your answer.

PHYSICAL ADAPTATIONS

BACKGROUND INFORMATION

- Almost any structure that an organism has can be attributed to an adaptation to its environment. Physical adaptations are physical features of an organism. For example, the shape of a wing, the number of legs, the colour or pattern of the fur, the shape and size of a bird's bill, the fur on a bear, the size and shape of an animal's teeth, or the shape and colour of a flower all directly contribute to a species' ability to survive.

TEACHING STRATEGIES

- Brainstorm with your students on the adaptations that they think a beaver has to survive and reproduce in its environment (Figure 8.3). List these on the board or flipchart paper. Or photocopy and distribute BLM 8.2, The Beaver for your students. Have your students read through this worksheet and underline or highlight all of the adaptations of the beaver. Go back to the students' original list and compare it with the information they have just read.
- Ask students to choose an organism in a different habitat and list key adaptations in their logbooks.
- As students read the materials, have them add details about the different types of adaptations to the mind map they began in the chapter opener. This will provide a study guide and visual representation of information they learn.

READING Check

Yes, the sense of smell is an adaptation that helps humans survive. The sense of smell is a primitive sense for humans as well as animals. From an evolutionary standpoint it is one of the most ancient of senses. Smell allows vertebrates and other organisms with smell receptors to identify food, mates, and predators, and provides sensual pleasure from smells such as the odour of flowers, perfume, or food. It also warns us of danger such as spoiled food, chemical dangers, or fire. For both humans and animals, it is one of the important means by which our environment communicates with us.

FIND OUT ACTIVITY 8-B
PICKY EATERS

Purpose

- Students compare different tools and predict how the shape of a bird's beak influences what it eats.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 or 3 days before	– Gather the materials.
1 day before	– Photocopy BLM 8-3, Picky Eaters Chart (optional).

MATERIALS	
– tongs	– gummy worms
– clothespins	– jelly bean
– tweezers	– chocolate chip
– scissors	– sunflower seeds (in shell)

Suggested Time

- 40 min

Safety Precautions

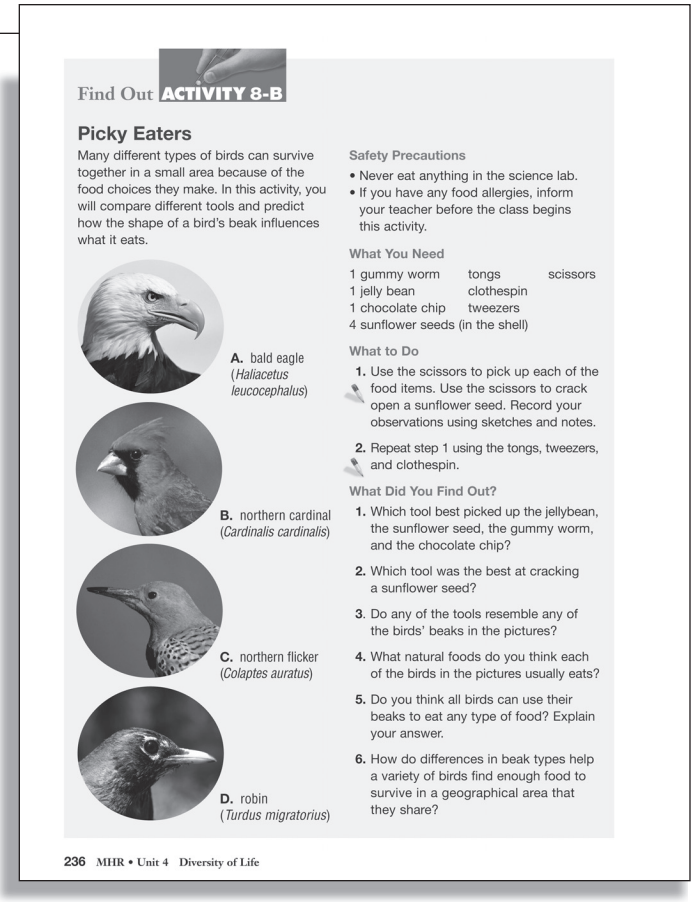
- Remind students they must never eat anything in the science lab.
- Ask if any students have food allergies before the class begins this activity.
- Remind students that all tools should be handled with care to prevent injury.

HINTS & HELPS

- Review the safety precautions with your students prior to starting the activity.
- Alternative tools include a nutcracker for a northern cardinal, a pick or a chisel for the northern flicker, needle-nose pliers for the robin, or a pair of pliers instead of the tongs to crack open seeds.
- Group your students into teams of four. Provide one set of materials per group.
- Have each student select one tool to start with and attempt to pick up each food item with that particular tool.

Implementing the Activity

- Have students study the pictures of the four birds on page 236 of the student textbook. Discuss how the shapes of the beaks are adapted for picking up and eating different types of foods. Birds with short, hooked, strong beaks are meat eaters. Insect eaters have slender, sharp-pointed beaks. Thick and wedged beaks are used for seed cracking. Long, slender, bent beaks are used for probing in the mud. Broad and serrated beaks are used for tearing plants and grazing.
- Distribute BLM 8-3, Picky Eaters Chart for students to use to record their findings. Alternatively, have students prepare their own chart.



Find Out ACTIVITY 8-B

Picky Eaters

Many different types of birds can survive together in a small area because of the food choices they make. In this activity, you will compare different tools and predict how the shape of a bird's beak influences what it eats.

Safety Precautions

- Never eat anything in the science lab.
- If you have any food allergies, inform your teacher before the class begins this activity.

What You Need

1 gummy worm, 1 jelly bean, 1 chocolate chip, 4 sunflower seeds (in the shell), tongs, clothespin, tweezers, scissors

What to Do

1. Use the scissors to pick up each of the food items. Use the scissors to crack open a sunflower seed. Record your observations using sketches and notes.
2. Repeat step 1 using the tongs, tweezers, and clothespin.

What Did You Find Out?

1. Which tool best picked up the jellybean, the sunflower seed, the gummy worm, and the chocolate chip?
2. Which tool was the best at cracking a sunflower seed?
3. Do any of the tools resemble any of the birds' beaks in the pictures?
4. What natural foods do you think each of the birds in the pictures usually eats?
5. Do you think all birds can use their beaks to eat any type of food? Explain your answer.
6. How do differences in beak types help a variety of birds find enough food to survive in a geographical area that they share?

A. bald eagle (*Haliaceetus leucocephalus*)

B. northern cardinal (*Cardinalis cardinalis*)

C. northern flicker (*Colaptes auratus*)

D. robin (*Turdus migratorius*)

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Adaptation

- If materials are in short supply, do this as a demonstration. Use the POE method for demonstrations: P-predict; O-observe; E-evaluate. However, this is an excellent activity for kinesthetic learners and for raising awareness of a relatively small characteristic.

Activity Wrap-Up

- If your school is in an area that is good for bird-watching, consider taking students outside and have them observe the birds' feeding behaviours. Follow all school policies and procedures for taking students out of the classroom.

Assessment Option

- Collect and review student answers to *What Did You Find Out?* questions.

What Did You Find Out? Answers

1. Sample answers: The tweezers were the best at picking up the jelly bean; the tongs and tweezers both picked up the gummy worm; the tongs were the best at picking up the sunflower seed; and the tweezers were the best at picking up the chocolate chip.
2. Students will find that the scissors will crack the shell of the sunflower seed and actually shatter the inside seed. The tongs and tweezers can crack the shell without damaging the seed inside, while the clothespin cannot grasp it at all.

Adaptations for Protection

Some types of physical adaptations are very specific. For example, an organism's ability to blend into its surroundings is called **camouflage**. Camouflage hides animals while they wait for food to pass by or when predators are near. Can you see an organism in Figure 8.4? The sand-like pattern and colour on the fish in the photograph make it blend in with the sand on the ocean floor where it lives. This physical adaptation prevents it from becoming an easy meal.

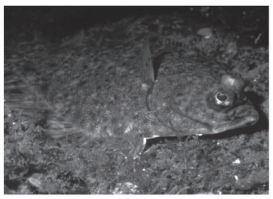


Figure 8.4 This fish's colouration makes it hard to see on the sand.

Other organisms camouflage themselves by mimicking the shape of something, possibly even another organism. Looking like something else—a natural object, or an organism that stings or tastes bad—is a physical adaptation called **mimicry**. Have you ever been stung by a bee or wasp? This experience would have taught you to avoid buzzing, black-and-yellow-striped insects, such as the yellow-jacket wasp shown in Figure 8.5(A). Animals that eat insects avoid wasps too. Insects with the bright colouration of the yellow-jacket wasp tend to sting. However, there are insects that have the same colouration as yellow-jacket wasps, such as the fly in Figure 8.5(B), which do *not* sting. Looking like an animal that *does* sting can help the fly to avoid being eaten by predators.

READING Check

How is mimicry an adaptation that helps organisms survive?

Ⓐ A yellow-jacket wasp Ⓑ A non-stinging fly

Figure 8.5 The colouration of the non-stinging fly mimics that of the stinging wasp. This is a type of camouflage called mimicry.

3. The scissors resemble the eagle's beak, the clothespin resembles the northern cardinal's beak, the tweezers resemble the northern flicker's beak, and the tongs resemble the robin's beak.
4. Bald eagles are meat-eaters (primarily fish, aquatic birds, and small mammals); northern cardinals eat seeds, grains, fruits and insects; northern flickers eat insects (ants are favourites); robins eat invertebrates (earthworms, beetles, and caterpillars), plus fruit (chokecherries, barberries, and rowan berries).
5. No. The beaks for birds are suited for specific types of food. For example, an eagle's beak is not shaped to dig for worms in the mud like a robin or pick insects from a tree like the northern flicker.
6. Different types of beaks allow a variety of birds to live in the same area because they are not competing for the same food. If all the birds in one area had the same type of beak, they would all be competing for the same food.

ADAPTATIONS FOR PROTECTION

BACKGROUND INFORMATION

- Both predators and prey use camouflage—predators to get closer to their prey, and prey to avoid being seen. Camouflage can be cryptic coloration (blending in), disruptive coloration (spots, stripes, or irregular patches of colour), or counter shading (dark colour on the upper body and pale colour below).
- Many mammals do not see in colour, and hunting often occurs just before dawn or just after dusk when the light is dim and colours are reduced to greys and whites.
  - Shown in Figure 8.4, the starry flounder (*Platichthys stellatus*) lives on the sandy bottom close to the shore along the Pacific coast from Alaska to California, and from the Bering Sea to Japan. Flounders use cryptic coloration to blend in. They can change colour depending on the type of sand. As larvae they have an eye on each side of their head, but as they mature one eye migrates. This is a physical adaptation that allows them to lie on the bottom of the ocean.
- Mimicry is a resemblance of one organism to another or to an object in the environment that has evolved to deceive predators.
  - Adult hover flies (see Figure 8.5B), which feed on pollen and nectar from flowers, mimic either wasps (Figure 8.5A) or bees. Hover flies have shorter antennae and only one pair of wings. There are 950 species of hover fly in North America.

TEACHING STRATEGIES

- Before students read the textbook, have them study Figures 8.4 and 8.5 to see what special features each organism has that might help protect it in its environment. In comparison to wasps and bees, adult hover flies (see Figure 8.5B) have shorter antennae and only one pair of wings.
- Make a class list of plants and animals that use camouflage to help them survive.

Common Misconception

- Students may believe that all animals use camouflage to avoid predators or to sneak up on potential prey. The poison dart frog doesn't hide. As a warning to predators of their extreme toxicity, poison dart frogs are spectacularly coloured and out in the open.

READING Check

Mimicry allows an organism to deceive a predator.

PROBLEM-SOLVING INVESTIGATION 8-C CAMOUFLAGE CREATURE

Purpose

- Students create a 3-D model of a creature or object that will be camouflaged in the classroom.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 week before	– Discuss the project and have students start gathering materials.

MATERIALS
– scissors – containers such as milk jugs, food containers, and boxes – small items such as pins, buttons, string, pipe cleaners, and craft sticks – art supplies

Suggested Time

- 40–60 min

HINTS & HELPS

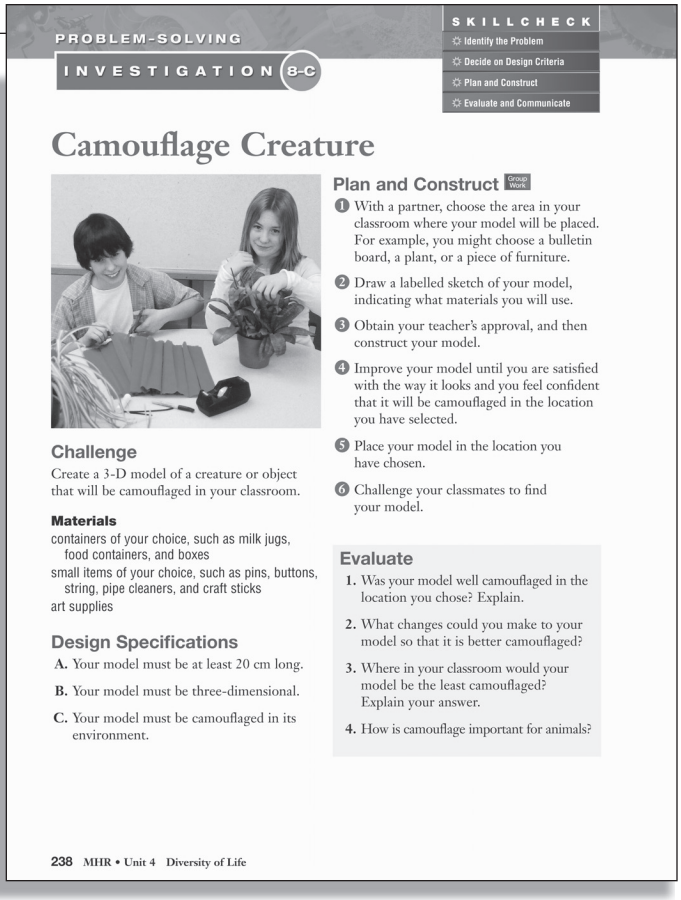
- Allow time 1 week prior to the activity for partners to discuss and plan what they will create and how it will be camouflaged. Discuss the meaning of *three-dimensional*.
- The class may wish to set some criteria related to the creature's size.
- This is an excellent project for students with learning disabilities or language difficulties to demonstrate their understanding of the adaptation of camouflage.

Implementing the Investigation

- Identify the problem: Students need to make a creature that can hide within its environment so it will be protected from its predators.

Investigation Wrap-Up

- Once the camouflaged models are hidden, invite another class to search for the creatures. Have the visiting students explain which models were the hardest to see and which were the easiest and why.
- Invite students to share the challenges they had in camouflaging their creature. What did they apply from what they learned from nature to try and camouflage their creature?



PROBLEM-SOLVING INVESTIGATION 8-C

SKILL CHECK
- Identify the Problem
- Decide on Design Criteria
- Plan and Construct
- Evaluate and Communicate

Camouflage Creature

Challenge

Create a 3-D model of a creature or object that will be camouflaged in your classroom.

Materials

containers of your choice, such as milk jugs, food containers, and boxes
small items of your choice, such as pins, buttons, string, pipe cleaners, and craft sticks
art supplies

Design Specifications

A. Your model must be at least 20 cm long.
B. Your model must be three-dimensional.
C. Your model must be camouflaged in its environment.

Plan and Construct (Group Work)

1. With a partner, choose the area in your classroom where your model will be placed. For example, you might choose a bulletin board, a plant, or a piece of furniture.
2. Draw a labelled sketch of your model, indicating what materials you will use.
3. Obtain your teacher's approval, and then construct your model.
4. Improve your model until you are satisfied with the way it looks and you feel confident that it will be camouflaged in the location you have selected.
5. Place your model in the location you have chosen.
6. Challenge your classmates to find your model.

Evaluate

1. Was your model well camouflaged in the location you chose? Explain.
2. What changes could you make to your model so that it is better camouflaged?
3. Where in your classroom would your model be the least camouflaged? Explain your answer.
4. How is camouflage important for animals?

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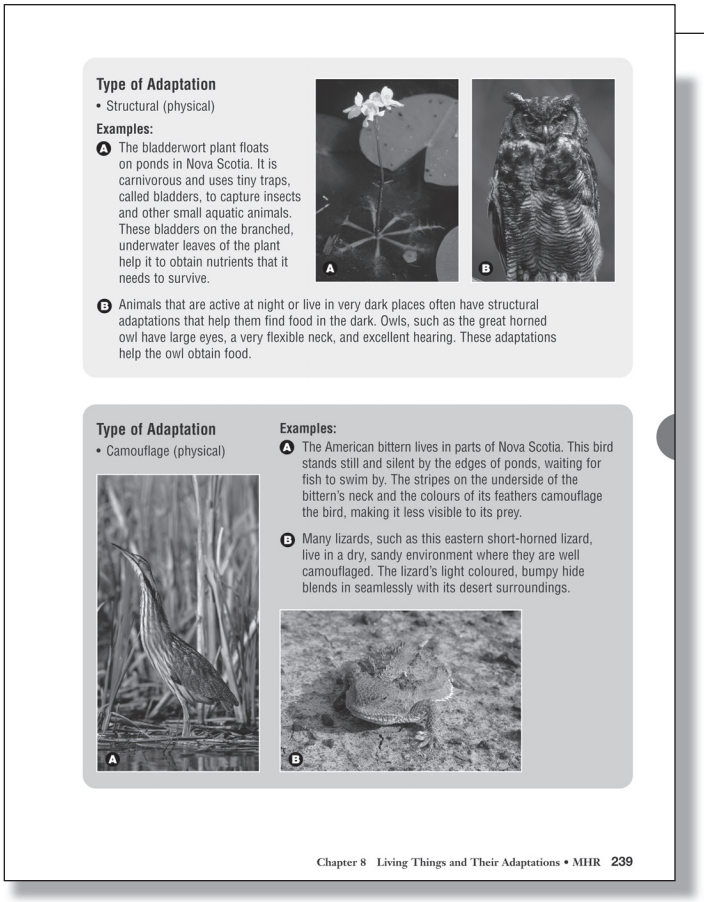
Assessment Option

- Use Process Skills Rubric 8, Developing Models to assess student work.

Evaluate Answers

1. 2. & 3. These answers will depend on the model's camouflage success.
4. Camouflage is important for animals because it allows them to blend in with their environment. This gives them both protection from their predators and a hunting advantage.



Type of Adaptation

• Structural (physical)

Examples:

A The bladderwort plant floats on ponds in Nova Scotia. It is carnivorous and uses tiny traps, called bladders, to capture insects and other small aquatic animals. These bladders on the branched, underwater leaves of the plant help it to obtain nutrients that it needs to survive.

B Animals that are active at night or live in very dark places often have structural adaptations that help them find food in the dark. Owls, such as the great horned owl have large eyes, a very flexible neck, and excellent hearing. These adaptations help the owl obtain food.

Type of Adaptation

• Camouflage (physical)

Examples:

A The American bittern lives in parts of Nova Scotia. This bird stands still and silent by the edges of ponds, waiting for fish to swim by. The stripes on the underside of the bittern's neck and the colours of its feathers camouflage the bird, making it less visible to its prey.

B Many lizards, such as this eastern short-horned lizard, live in a dry, sandy environment where they are well camouflaged. The lizard's light coloured, bumpy hide blends in seamlessly with its desert surroundings.

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ADAPTATION: STRUCTURAL CARD INSET

BACKGROUND INFORMATION

- Structural adaptations can be visible or internal. Challenge students to think of some internal structures (such as their blood, bones, or body organs) that allow them to survive.

TEACHING STRATEGIES

- Ask students to speculate on what happens to an owl with a stiff neck. You could use this discussion as a lead-in to asking students if they have ever heard the phrase "the survival of the fittest" and how they think it relates to the concept of adaptations. Remind students that in this case, "fit" refers to how well-suited the organism is to its environment.
- Ask students to suggest other structural adaptations that help with survival. (Consider the lynx from Activity 7-B (page 209 in student textbook), with its large paws for staying on top of the snow.)

ADAPTATION: CAMOUFLAGE CARD INSET

BACKGROUND INFORMATION

- The American bittern is more often heard than seen. When it is disturbed in a marsh or wetland area, it will stand with its neck and head straight up and sway slightly, allowing it to blend in with the surrounding cattails and grasses.

TEACHING STRATEGIES

- Ask students to reflect on reptiles they are familiar with. Do they all have camouflage colouring? What do they think would happen if the eastern short-horned lizard was transported to a meadow?

Connecting to the World Outside the School

- Camouflage is an important defence tactic. Students may make an obvious link to military use of camouflage in everything from uniforms and equipment to aircraft like the *F-117* shown on page 102 of the Flight chapter in the student textbook. Students who have family in the military could discuss the kind of camouflage they have seen in use.

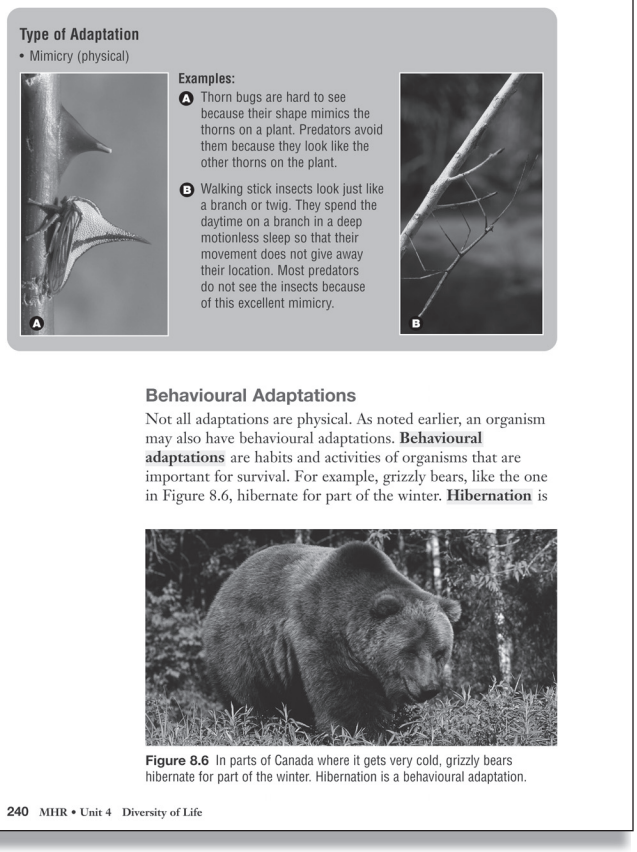
ADAPTATION: MIMICRY CARD INSET

BACKGROUND INFORMATION

- The thorn bug (*Umbonia crassicornis*) is a member of the treehopper family. The adults are 1.3 cm long and feed on the sap of the tree. Young thorn bugs eat aphids. The thorn bug's wedge-shaped shell serves as protective armour, providing a sharp point at each corner.
- Mimicry, as opposed to camouflage and warning coloration, is specifically a resemblance, however the same techniques of deception are sometimes used in all three anti-predatory devices. These include variations in colour, pattern, and structure.
- The viceroy and monarch butterflies were once thought to exhibit a form of mimicry where a harmless species (viceroy) mimics a toxic species (monarch). Studies conducted in the early 1990s suggest that the viceroy and the monarch are actually equally toxic. The two species mimic each other to the benefit of both.

TEACHING STRATEGIES

- During a field trip, challenge students to test their powers of observation to see if they can spot organisms that successfully mimic other organisms.



Type of Adaptation

• Mimicry (physical)

Examples:

A Thorn bugs are hard to see because their shape mimics the thorns on a plant. Predators avoid them because they look like the other thorns on the plant.

B Walking stick insects look just like a branch or twig. They spend the daytime on a branch in a deep motionless sleep so that their movement does not give away their location. Most predators do not see the insects because of this excellent mimicry.

Behavioural Adaptations

Not all adaptations are physical. As noted earlier, an organism may also have behavioural adaptations. **Behavioural adaptations** are habits and activities of organisms that are important for survival. For example, grizzly bears, like the one in Figure 8.6, hibernate for part of the winter. **Hibernation** is

Figure 8.6 In parts of Canada where it gets very cold, grizzly bears hibernate for part of the winter. Hibernation is a behavioural adaptation.

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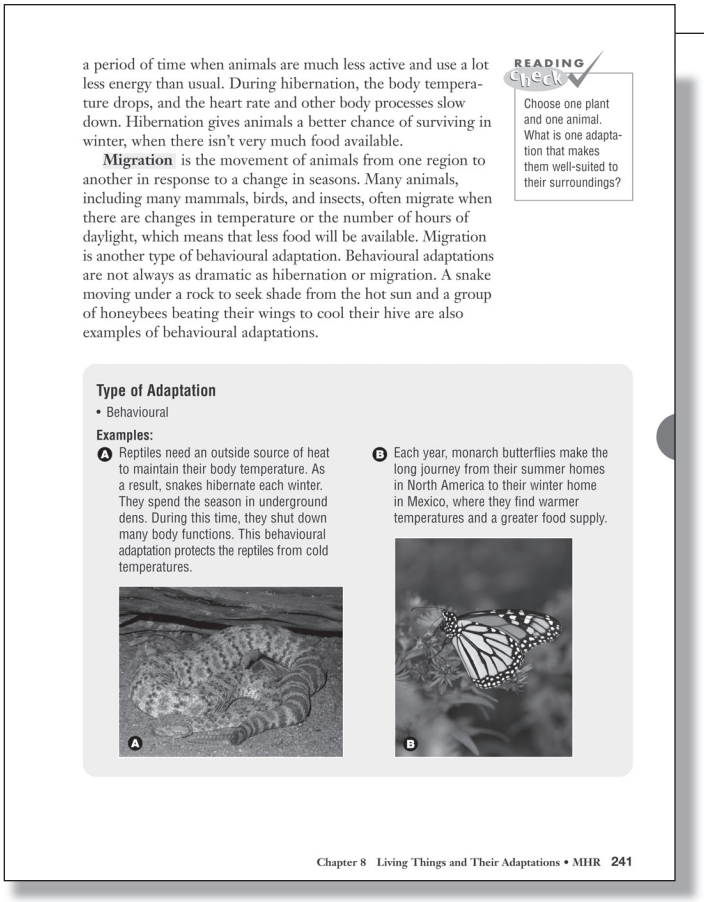
ADAPTATION: BEHAVIOURAL CARD INSET

BACKGROUND INFORMATION

- Behavioural adaptations include nest building, courtship dances, communicating, and defending territory (territorial behaviour is very common in birds), as well as the ways organisms move through their environment.
- Behaviour patterns are genetically programmed. An animal's genetic make-up determines how it reacts to certain stimuli. A mouse doesn't fly, but it will run away when a cat appears. A hummingbird won't try to dig a tunnel, but it knows when to fly south for the winter.
- The variability of behaviour among individuals affects their ability to survive and reproduce. Individuals with behaviour that makes them more successful at surviving and reproducing (such as being able to detect predators or run fast) tend to produce more offspring than individuals without that behaviour. These offspring will inherit the genetic basis for the successful behaviour.



a period of time when animals are much less active and use a lot less energy than usual. During hibernation, the body temperature drops, and the heart rate and other body processes slow down. Hibernation gives animals a better chance of surviving in winter, when there isn't very much food available.

Migration is the movement of animals from one region to another in response to a change in seasons. Many animals, including many mammals, birds, and insects, often migrate when there are changes in temperature or the number of hours of daylight, which means that less food will be available. Migration is another type of behavioural adaptation. Behavioural adaptations are not always as dramatic as hibernation or migration. A snake moving under a rock to seek shade from the hot sun and a group of honeybees beating their wings to cool their hive are also examples of behavioural adaptations.

READING Check

Choose one plant and one animal. What is one adaptation that makes them well-suited to their surroundings?

Type of Adaptation

• Behavioural

Examples:

A Reptiles need an outside source of heat to maintain their body temperature. As a result, snakes hibernate each winter. They spend the season in underground dens. During this time, they shut down many body functions. This behavioural adaptation protects the reptiles from cold temperatures.

B Each year, monarch butterflies make the long journey from their summer homes in North America to their winter home in Mexico, where they find warmer temperatures and a greater food supply.

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- Grizzly bears overwinter in dens that they excavate and then line with leaves, grasses, spruce or fir branches, and pine needles. Denning occurs from October or November to April or May depending on the latitude: the further north, the longer the denning period. During their winter sleep, the bears do not defecate or urinate. This would normally mean that nitrogenous wastes would poison the urinary system. Instead, the bear's body diverts nitrogen from pathways that synthesize urea into pathways that generate amino acids and new proteins.
- Bats, chipmunks, and squirrels are true hibernators. Oxygen consumption decreases, and breathing rates decline. Hibernation conserves energy. Animals that hibernate typically eat vast amounts of food to build up body fat before hibernation. This fat fuels the animal's body for its slowed-down body processes. The squirrel's body temperature drops to within a few degrees of the cold outside its den. Its heart will beat only once or twice a minute. When it is active the squirrel may breathe a few hundred times each minute, but in hibernation it takes a slow breath only once every 5 minutes. Despite these changes, its blood remains saturated with oxygen, and little-used muscles remain in tone, ready for action, when the squirrel awakens.
- Migration is an instinctive, seasonal movement of animals. In North America, about two-thirds of bird species fly south in the fall to areas where food will be available during winter. The birds fly north in the spring to areas where they breed. Monarch butterflies fly south and winter in the mountains of Mexico.
- Many species of whales also migrate. Right whales are not known to travel the huge distances that species such as humpbacks and grays do. Nonetheless, some right whales make annual migrations between their winter breeding and calving grounds in warmer southern waters to their summer feeding grounds in cooler waters.

TEACHING STRATEGIES

- Bring in a local birding expert and ask them discuss the different species of migratory birds in your area or join students outside to observe the birds.
- Ask students to consider why some animals hibernate and others migrate. What do they think these behaviours have in common? (Both protect the animal from temperatures they are not well adapted to and help them conserve energy when food is scarce.)

Common Misconception

- While bears can exist for 3 months or more without food or water, they are not considered to be true hibernators. Their body temperature and breathing rate stays normal. They burn an estimated 4000 calories a day. While in hibernation they often awaken and move about. Some will even awake and prowl around for a few hours or days at a time.

READING Check Students could use one plant and animal species listed in the textbook, print and/or Internet resources. They could also use family pets. The students should record the physical and/or behavioural adaptations of the chosen species in their logbook.

THINK & LINK INVESTIGATION 8-D MATCHING ADAPTATIONS

Purpose

- Students match a plant or animal with either its adaptation or the survival benefit the adaptation provides.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 weeks before	– Book library.
1 day before	– Photocopy Process Skills Rubric 8, Developing Models (optional).

Suggested Time

- 15 min to complete main activity
- 90 min to complete Conclude and Apply question 3

Figure page 242

- Snowshoe hares: large well-furred hind feet move easily over the snow; four long toes of each foot spread wide in soft snow, increasing the size of these "snowshoes"; also seasonal variation in fur colour, from grey-brown in summer to almost pure white in midwinter.
- Lynx: wide, furry paws that act like snowshoes; long legs to carry it through deep powder; ear tufts, which keep the tips of ears from freezing and enhance hearing.

HINTS & HELPS

- Ask your librarian to set aside any print or digital resources on the plants and animals listed for question 3.
- If students will be using the Internet, bookmark sites ahead of time.
- Photocopy and distribute relevant Learning Checklists to guide student presentations.

Implementing the Investigation

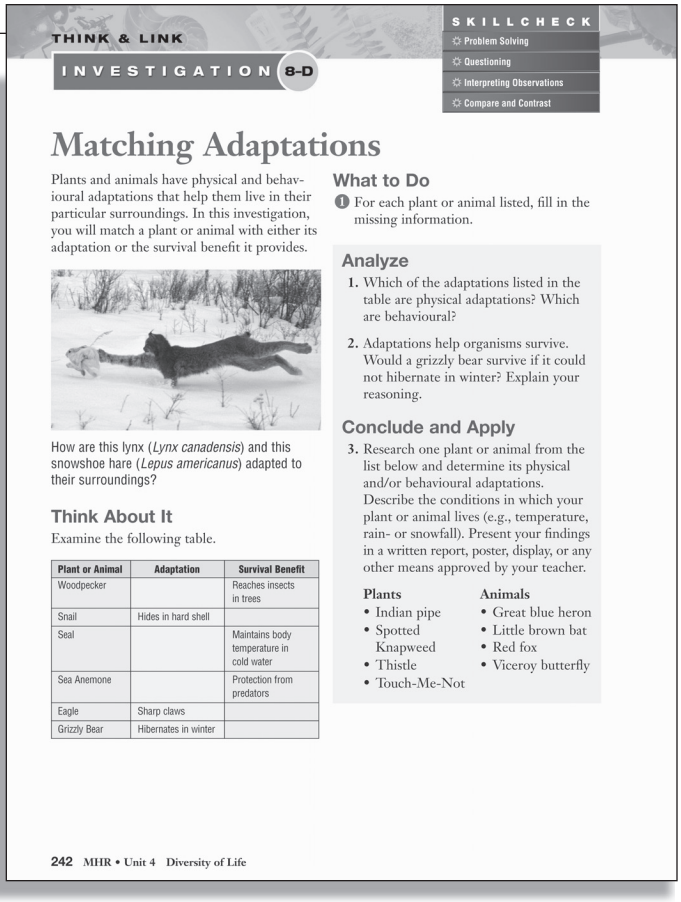
- Ask students to copy the chart on page 242 into their logbooks.
- Conclude and Apply question 3 is an activity that could take two classes to complete.
- Enrich the activity by adding guiding questions and/or a compare/contrast to a similar animal.

Adaptation

- Consider doing this investigation as a class discussion to assist students who have difficulty with reading material. Bring in or show photographs and have your students fill in the chart as you discuss each animal.

Investigation Wrap-Up

- Have students complete Conclude and Apply question 3. This activity will reinforce the concepts of physical and behavioural adaptations of plants as well as animals.



THINK & LINK

INVESTIGATION 8-D

SKILL CHECK
- Problem Solving
- Questioning
- Interpreting Observations
- Compare and Contrast

Matching Adaptations

Plants and animals have physical and behavioural adaptations that help them live in their particular surroundings. In this investigation, you will match a plant or animal with either its adaptation or the survival benefit it provides.

How are this lynx (*Lynx canadensis*) and this snowshoe hare (*Lepus americanus*) adapted to their surroundings?

Think About It

Examine the following table.

Plant or Animal	Adaptation	Survival Benefit
Woodpecker		Reaches insects in trees
Snail	Hides in hard shell	
Seal		Maintains body temperature in cold water
Sea Anemone		Protection from predators
Eagle	Sharp claws	
Grizzly Bear	Hibernates in winter	

What to Do

1. For each plant or animal listed, fill in the missing information.

Analyze

1. Which of the adaptations listed in the table are physical adaptations? Which are behavioural?
2. Adaptations help organisms survive. Would a grizzly bear survive if it could not hibernate in winter? Explain your reasoning.

Conclude and Apply

3. Research one plant or animal from the list below and determine its physical and/or behavioural adaptations. Describe the conditions in which your plant or animal lives (e.g., temperature, rain- or snowfall). Present your findings in a written report, poster, display, or any other means approved by your teacher.

Plants
- Indian pipe
- Spotted Knapweed
- Thistle
- Touch-Me-Not

Animals
- Great blue heron
- Little brown bat
- Red fox
- Viceroy butterfly

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Assessment Option

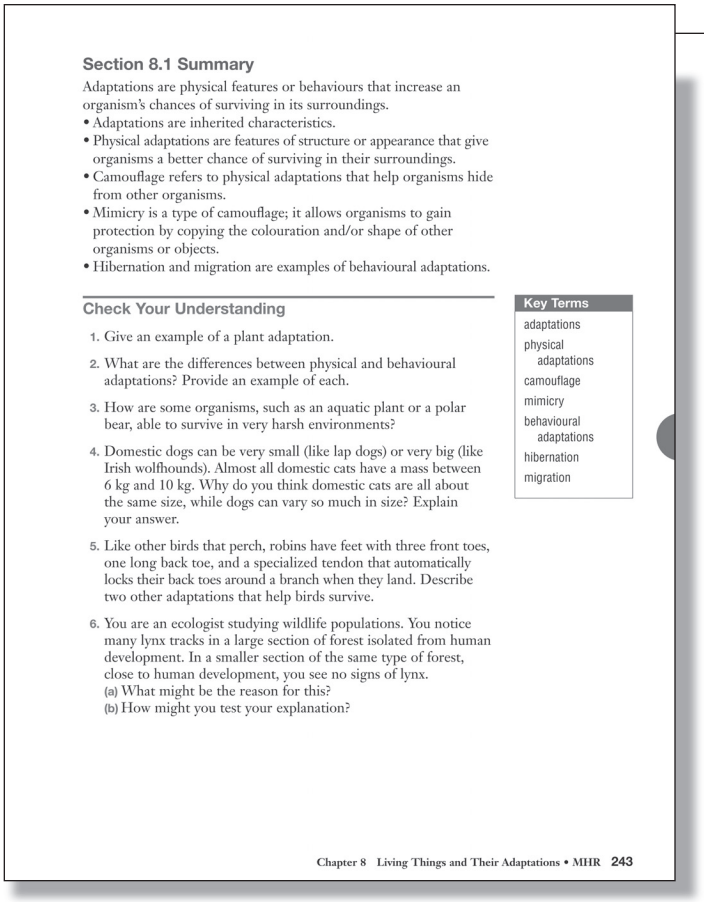
- Review Learning Skills Checklists with students to assess their chosen form of presentation.

Analyze Answers

1. • Woodpecker: beak is a physical adaptation, helps access food.
   • Snail: hard shell is a protective physical adaptation; withdrawing into the shell is a protective behavioural adaptation.
   • Seals: heat is conserved by a thick layer of blubber under their skin, a layer of fur, and a compact body shape (physical adaptations).
   • Sea anemones: stinging cells are protective physical adaptations.
   • Eagle: sharp claws are physical adaptations that allow it to catch, kill, and eat prey.
   • Grizzly bear: winter hibernation is a behavioural adaptation that helps bears survive when food is scarce.
2. A grizzly would not survive winter if it didn't hibernate because food is scarce. Some students may note that this is when females have their young.

Conclude and Apply Answers

3. Student answers must clearly define the conditions of the chosen organism's habitat/environment and describe the physical and/or



Section 8.1 Summary

Adaptations are physical features or behaviours that increase an organism's chances of surviving in its surroundings.
- Adaptations are inherited characteristics.
- Physical adaptations are features of structure or appearance that give organisms a better chance of surviving in their surroundings.
- Camouflage refers to physical adaptations that help organisms hide from other organisms.
- Mimicry is a type of camouflage; it allows organisms to gain protection by copying the colouration and/or shape of other organisms or objects.
- Hibernation and migration are examples of behavioural adaptations.

Check Your Understanding

1. Give an example of a plant adaptation.
2. What are the differences between physical and behavioural adaptations? Provide an example of each.
3. How are some organisms, such as an aquatic plant or a polar bear, able to survive in very harsh environments?
4. Domestic dogs can be very small (like lap dogs) or very big (like Irish wolfhounds). Almost all domestic cats have a mass between 6 kg and 10 kg. Why do you think domestic cats are all about the same size, while dogs can vary so much in size? Explain your answer.
5. Like other birds that perch, robins have feet with three front toes, one long back toe, and a specialized tendon that automatically locks their back toes around a branch when they land. Describe two other adaptations that help birds survive.
6. You are an ecologist studying wildlife populations. You notice many lynx tracks in a large section of forest isolated from human development. In a smaller section of the same type of forest, close to human development, you see no signs of lynx.
   (a) What might be the reason for this?
   (b) How might you test your explanation?

Key Terms
adaptations
physical adaptations
camouflage
mimicry
behavioural adaptations
hibernation
migration

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behavioural adaptations that enable it to survive there. Reports should include information on where it lives and how it gets food, as well as reproduction. Depending on the format of the final report, students could be provided with one of the following Learning Checklists: 3, Oral Presentation; 4, Computer Slide Show Presentation; or 5, Poster in order to ensure that they meet basic criteria.

Section 8.1 Summary

Read the section summary together as a class and discuss any questions students might have. Have students make a spider diagram or other graphic organizer to summarize this section. To further practise what they know, students could devise questions to ask a partner.

✓ ASSESSMENT OPTIONS FOR SECTION 8.1

- Collect and review science logbooks, using Learning Skills Rubric 2, Science Logbook to evaluate students' writing and drawings.
- Use the following rubrics or checklists to assess student work:
  – Process Skills Rubric 8, Developing Models for Problem-Solving Investigation 8-C: Camouflage Creature
  – Learning Checklists: 3, Oral Presentation; 4, Computer Slide Show Presentation; or 5, Poster for Think & Link Investigation 8-D: Matching Adaptations
- For Find Out Activity 8-B: Picky Eaters, collect and review student answers to *What Did You Find Out?* answers.

Check Your Understanding Answers

1. Students' answers must relate an adaptation to a condition in a habitat. Sample answer: plants in a dry area have bigger root systems than those in a wet area in order to access scarce water and nutrients.
2. Physical adaptations are structures or visible characteristics that give organisms a better chance of survival. Sample answers: claws on a grizzly bear or the curved beak of an eagle. Behavioural adaptations are habits and activities of organisms that are important for survival. Sample answers: hibernation and migration.
3. Aquatic plants and polar bears have physical and/or behavioural adaptations that allow them to survive in harsh environments. Examples:
   - polar bears have thick winter coats and a thick layer of fat beneath their skin to keep them warm; white fur serves as camouflage.
   - aquatic plants have structural adaptations that allow them to regulate water intake and access the Sun's light. They also usually have a root structure that anchors them securely but is flexible enough to move with the water.
4. Humans have bred dogs for specific jobs such as pulling sleds or hunting game. Each breed of dog has specific adaptations to carry out that job. Humans have bred cats for their appearance.
5. Sample answers: Specialized beaks help birds eat their food, which could be flesh or seeds. Coloration helps birds hide from predators. Migration helps them survive harsh winters.
6. (a) Lynx are shy and would tend to stay away from humans. Or human activity may reduce the prey that the lynx would normally eat—without food, the lynx will move to another area.
   (b) Students may suggest the use of radio collars and tracking individual lynx or simply observing the two areas for extended periods of time. Accept any reasonable answer.

SECTION 8.2 ADAPTATIONS AND CHANGE

What Students Do in Section 8.2

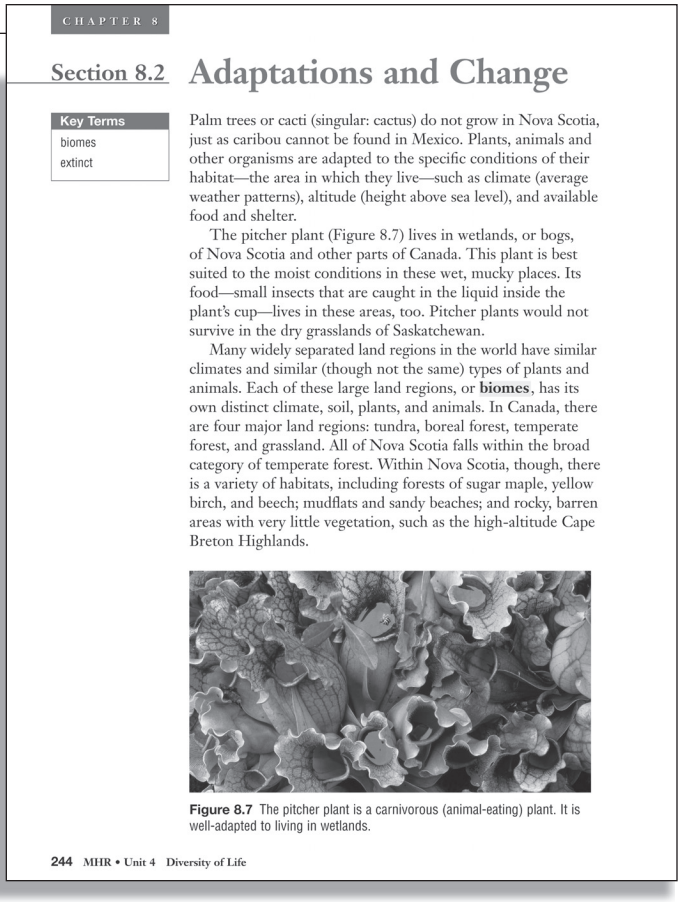
- match specific animals to specific biomes
- sample organisms living in terrestrial ecosystems
- summarize the characteristics of the main biomes of the world
- explain how fossils can be used to explain how biomes have changed
- predict how areas disturbed by human activity will look in the future
- make a species profile

BACKGROUND INFORMATION

- Scientists classify the biological communities of Earth into biomes. Each biome is characterized by dominant vegetation, climate, geographic location, and other characteristics. There are fresh-water and ocean (aquatic) biomes, however, the focus in this chapter is on terrestrial biomes.
- The dominant (climax) vegetation in a biome is determined by the climate of that region. For example, a warm, arid climate in the rain shadow of a mountain range can result in the development of a desert with characteristic plants. A warm, moist climate would support the growth of a forest and the likelihood of forest-dwelling plants. All terrestrial biomes also have characteristic micro-organisms, fungi, plants, and animals.
- The climate of an area is defined by a region's average monthly temperature and the total monthly precipitation, averaged over 30 years. Remind students that weather is about today, climate refers to long-term patterns. Or suggest that weather changes frequently; climate stays the same.
- The pitcher plant (Figure 8.7) is commonly found in the bogs of the northeastern part of North America. It is a carnivorous plant—a meat-eater. Carnivorous plants usually live in nitrogen-poor soils. They have adapted to the inadequate nitrogen levels by capturing and consuming insects.

TEACHING STRATEGIES

- Make a terrarium of a bog ecosystem and a terrarium of a desert ecosystem. Order pitcher plants as well as other plants found in wetland ecosystems. Order cacti or other plants found in a desert ecosystem. Observe how the non-living (abiotic) factors in each of these environments determine the plants (biotic community) that can survive.



CHAPTER 8

Section 8.2 **Adaptations and Change**

Key Terms
biomes
extinct

Palm trees or cacti (singular: cactus) do not grow in Nova Scotia, just as caribou cannot be found in Mexico. Plants, animals and other organisms are adapted to the specific conditions of their habitat—the area in which they live—such as climate (average weather patterns), altitude (height above sea level), and available food and shelter.

The pitcher plant (Figure 8.7) lives in wetlands, or bogs, of Nova Scotia and other parts of Canada. This plant is best suited to the moist conditions in these wet, mucky places. Its food—small insects that are caught in the liquid inside the plant's cup—lives in these areas, too. Pitcher plants would not survive in the dry grasslands of Saskatchewan.

Many widely separated land regions in the world have similar climates and similar (though not the same) types of plants and animals. Each of these large land regions, or **biomes**, has its own distinct climate, soil, plants, and animals. In Canada, there are four major land regions: tundra, boreal forest, temperate forest, and grassland. All of Nova Scotia falls within the broad category of temperate forest. Within Nova Scotia, though, there is a variety of habitats, including forests of sugar maple, yellow birch, and beech; mudflats and sandy beaches; and rocky, barren areas with very little vegetation, such as the high-altitude Cape Breton Highlands.

Figure 8.7 The pitcher plant is a carnivorous (animal-eating) plant. It is well-adapted to living in wetlands.

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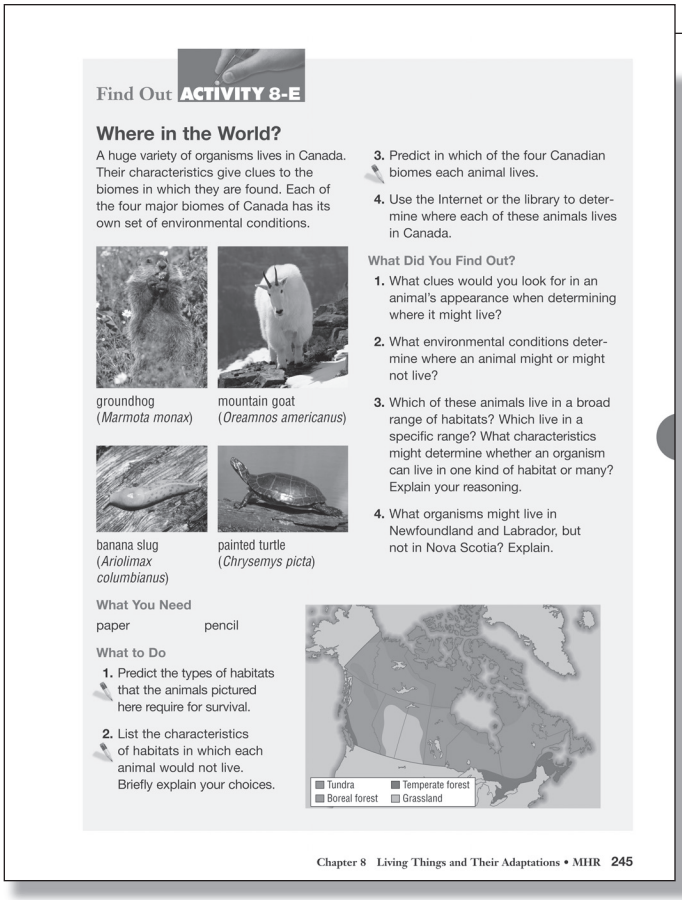
- Photocopy and distribute BLM 8.4, Canadian Biomes, or make an overhead transparency of this BLM. Read page 244 with your students while pointing out the various locations mentioned in the textbook. If possible, use photographs to show main vegetation patterns found in each biome.

Common Misconception

- Students may think that all deserts are hot and dry and devoid of life. Point out that deserts cover about one fifth of the Earth's surface. Any area where rainfall is less than 50 cm a year is classified as a desert. Although most deserts, such as the Sahara of North Africa and the deserts of the southwestern U.S., Mexico, and Australia, are at low latitudes, another kind of desert, cold deserts, occur in the basin and range area of Utah and Nevada and in parts of western Asia. Most deserts have lots of specialized vegetation, as well as specialized vertebrate and invertebrate animals.



Find Out ACTIVITY 8-E

Where in the World?

A huge variety of organisms lives in Canada. Their characteristics give clues to the biomes in which they are found. Each of the four major biomes of Canada has its own set of environmental conditions.

groundhog (*Marmota monax*)

mountain goat (*Oreamnos americanus*)

banana slug (*Ariolimax columbianus*)

painted turtle (*Chrysemys picta*)

What You Need

paper pencil

What to Do

1. Predict the types of habitats that the animals pictured here require for survival.
2. List the characteristics of habitats in which each animal would not live. Briefly explain your choices.
3. Predict in which of the four Canadian biomes each animal lives.
4. Use the Internet or the library to determine where each of these animals lives in Canada.

What Did You Find Out?

1. What clues would you look for in an animal's appearance when determining where it might live?
2. What environmental conditions determine where an animal might or might not live?
3. Which of these animals live in a broad range of habitats? Which live in a specific range? What characteristics might determine whether an organism can live in one kind of habitat or many? Explain your reasoning.
4. What organisms might live in Newfoundland and Labrador, but not in Nova Scotia? Explain.

FIND OUT ACTIVITY 8-E WHERE IN THE WORLD?

Purpose

- Students predict which biome each of the four animals lives in.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
2 to 3 weeks before	– Book library.
1 week before	– Bookmark specific web sites for your students.
1 day before	– Photocopy BLM 8.4, Canadian Biomes.

MATERIALS
– digital or print reference materials – paper – pencils

Suggested Time

- 30-45 min

HINTS

- Ask your librarian to set aside any print resources on the animals pictured in this activity.
- Bookmark a web site(s) for each animal pictured in this activity.

Implementing the Activity

- Group your students into teams of four. Assign one animal to each student. Give them a limited amount of time to do their library or Internet research.

Adaptations

- Provide bookmarked web sites for students who are less proficient with computers.
- Offer the option of researching four plants in four different biomes.

Activity Wrap-Up

- Photocopy and distribute BLM 8.4, Canadian Biomes. Have students colour or shade in the range where each animal is commonly found.

Assessment Option

- Use Process Skills Rubric 14, Predicting to assess students' conclusions.

What Did You Find Out? Answers

1. Students may cite coloration, body covering, limbs, mobility, or feet. Accept all answers where students can establish a link between the characteristic and an environment.
2. Environmental conditions include prevalence of predators, type of terrain, amount and types of precipitation, average annual temperature, amount of available light and accessible water, as well as severity of seasons.
3. The groundhog and painted turtle are generalists and can live in a wide range of habitats. The banana slug is only found in the temperate rain forests of British Columbia where the winters are mild and the area receives a lot of precipitation. The mountain goat has adaptations that allow it to live above the treeline in the Rocky Mountains of Alberta and British Columbia.

   The specialists have adaptations that suit them to extremes—lots of water and heat or barren terrain and harsh winters. The generalists tend to eat a wider variety of foods and are able to withstand a broader range of temperatures or precipitation but usually struggle in extreme conditions.
4. The polar bear may be a popular choice. Polar bears are adapted to live in the tundra where there is pack ice. The tundra environment is found in northern Labrador but not in Nova Scotia. Native turtles live in Nova Scotia but not in P.E.I. or Newfoundland and Labrador. Accept all reasonable answers.

FIND OUT ACTIVITY 8-F CHECKING OUT THE NEIGHBOURHOOD

Purpose

- Students will sample the organisms living in two research sites and compare the results.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
4 weeks before	– Order soil thermometers from a local scientific supply company.
1 week before	– Gather the materials.

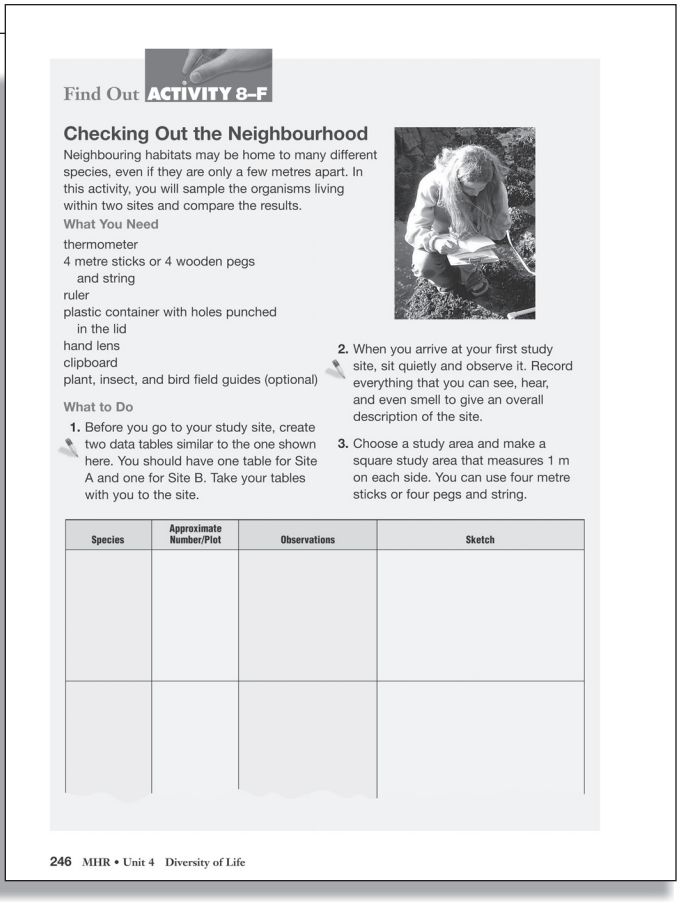
MATERIALS
– soil thermometers – 4 metre sticks per group or 4 wooden pegs and string – ruler – plastic container – hand lens – clipboard – trowel and/or a sweep net – plastic garbage bag – plant, insect, and bird field guides (optional)

Suggested Time

- 60 min to conduct the investigation
- 30 min to complete *What Did You Find Out?* questions

Safety Precautions

- Clear the area of broken glass, nails, or other sharp objects before starting the investigation.
- If you are near water, make sure students understand all of the safety precautions related to working in or near water.
- Make sure any students with allergies to bee or wasp stings or other insect bites have their medication with them.
- Students should be advised to apply sunscreen and, if necessary, insect repellent before heading outdoors.
- Soil temperatures should only be taken using a proper soil thermometer. A regular thermometer could easily break.



Find Out ACTIVITY 8–F

Checking Out the Neighbourhood

Neighbouring habitats may be home to many different species, even if they are only a few metres apart. In this activity, you will sample the organisms living within two sites and compare the results.

What You Need

thermometer
4 metre sticks or 4 wooden pegs and string
ruler
plastic container with holes punched in the lid
hand lens
clipboard
plant, insect, and bird field guides (optional)

What to Do

1. Before you go to your study site, create two data tables similar to the one shown here. You should have one table for Site A and one for Site B. Take your tables with you to the site.
2. When you arrive at your first study site, sit quietly and observe it. Record everything that you can see, hear, and even smell to give an overall description of the site.
3. Choose a study area and make a square study area that measures 1 m on each side. You can use four metre sticks or four pegs and string.

Species	Approximate Number/Plot	Observations	Sketch

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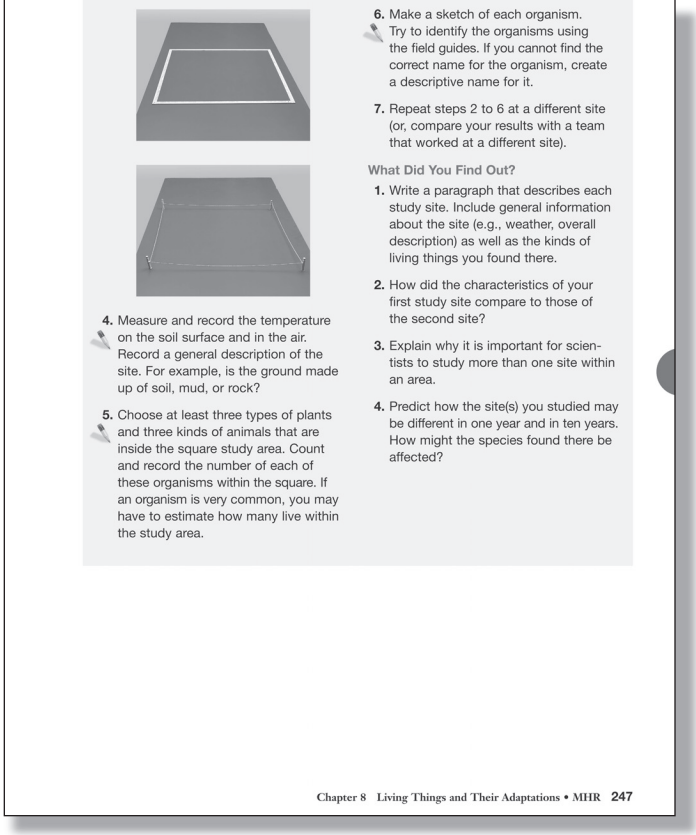
HINTS & HELPS

- Make sure you have followed all school policies with respect to taking children out of the classroom for this type of activity.
- Make sure students are properly attired for the weather conditions and location of the activity.
- If possible select two very different sites. For example:
  - an area dominated by long grass and an area dominated by cut grass
  - a woodland and a meadow or grassy area
  - a coniferous tree area and a deciduous tree area
  - a low, wet area and a sunny area of the schoolyard
  - an area with rich soil and an area with sandy soil
  - a sheltered area and one that is exposed to the wind
- Assign students to teams and have an equal number of teams study each area, for example, half the students in the low, wet area while the other half of your class samples the sunny area of your schoolyard. Ask students to divide up the work to be done during the field study.
- Reinforce the idea that students are going to be disturbing plants and animals in their natural habitat. They should be made aware that they should leave the area exactly as it was before they were there. For example, if students turn over a rock, they should replace it exactly the way that they found it. If they dig through the leaf litter, then they should replace the leaf litter.
- Enlist the help of parents or volunteers to help with supervision.
- Students with artistic skills could be enlisted to draw the different plants and animals that they observe. Alternatively, some students may wish to use a digital camera to record plants and other organisms.



4. Measure and record the temperature on the soil surface and in the air. Record a general description of the site. For example, is the ground made up of soil, mud, or rock?

5. Choose at least three types of plants and three kinds of animals that are inside the square study area. Count and record the number of each of these organisms within the square. If an organism is very common, you may have to estimate how many live within the study area.

6. Make a sketch of each organism. Try to identify the organisms using the field guides. If you cannot find the correct name for the organism, create a descriptive name for it.

7. Repeat steps 2 to 6 at a different site (or, compare your results with a team that worked at a different site).

What Did You Find Out?

1. Write a paragraph that describes each study site. Include general information about the site (e.g., weather, overall description) as well as the kinds of living things you found there.

2. How did the characteristics of your first study site compare to those of the second site?

3. Explain why it is important for scientists to study more than one site within an area.

4. Predict how the site(s) you studied may be different in one year and in ten years. How might the species found there be affected?

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Implementing the Activity

- Remind your students that abiotic (non-living) factors (temperature, moisture, wind, light, and soil conditions) act together to create the environment over a broad region of land. The environment determines the biotic (living) community in that region. However, micro-environments also exist. For example, soil in a hollow may contain more organic matter than soil on a nearby hill. Or the relative humidity in the summer is higher in tall grass than it is a metre above the grass. Or the air temperature in summer is higher at ground level than one metre above ground.
- Introduce the concept of a micro-climate: an area where very localized temperature and moisture conditions create a climate that is different from the overall climate of the area. For example, the micro-climate in a group of ferns in a woodland forest is similar to the climate of a tropical rain forest but different from the climate in the rest of the forest.
- Collecting organisms can be done with a sweep net. Students can transfer them to the plastic container and observe them with the hand lens. Students should record the names (if known), relative abundance, and any obvious adaptations that the animals have. They should sketch the organism in their logbooks. The animals should be released immediately after the information has been recorded.
- Students should use the trowel to collect some decomposing litter and humus. Students should spread the litter out on a plastic garbage bag and then use the hand lens to search for organisms. Students should record the names, their relative abundance, and adaptations and perhaps sketch them. Then they should return the animals and litter back to its original location.

Adaptation

- Samples can be made more accessible to students with physical disabilities by placing them on a tray and bringing them to the student.

Activity Wrap-Up

- Complete the *What Did You Find Out?* activities and questions.

Assessment Options

- Review students' field notes and any sketches to assess their observation work. Use Learning Skills Rubric 3, Co-operative Group Work to assess the team.

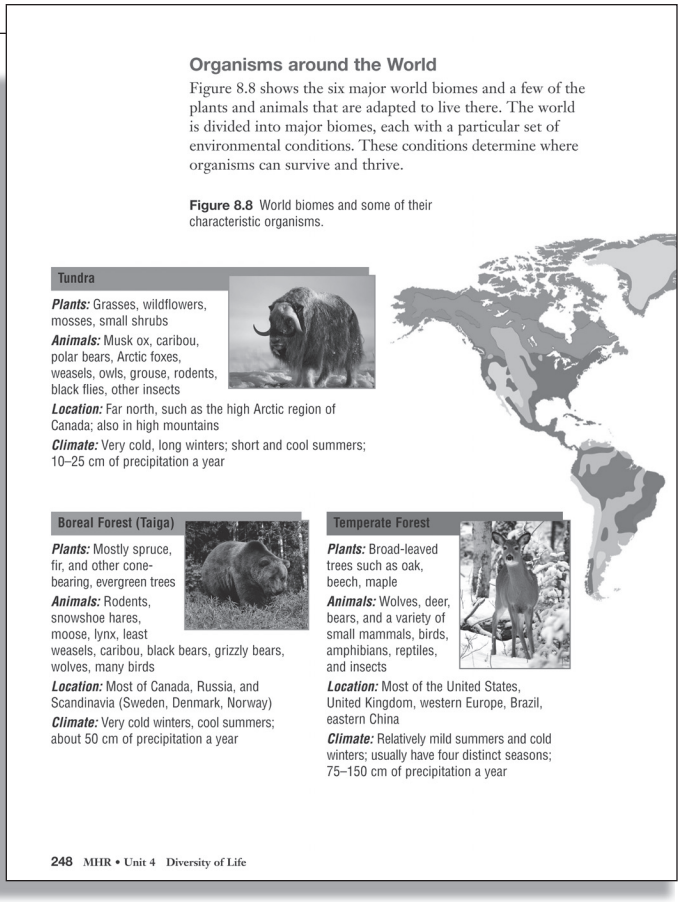
What Did You Find Out? Answers

1. Students' paragraphs should include headings and details related to the environment and its inhabitants.
2. Students' answers should follow a compare-and-contrast structure.
3. Even rather uniform areas such as a schoolyard are going to have slightly different environments (micro-environments) and climates (micro-climates). Sampling a number of areas within a site gives a more complete picture of the plants and animals found at the site.
4. Students will likely suggest that there will be little change in 1 year unless there is human intervention. There should be some recognition that in 10 years, even if the area is not disturbed by human activity, the number and types of species in the area will likely change. Students should suggest that sudden weather events as well as the gradual effects of climate will change the environment over 10 years and that the organisms in the area may change as a result.

ORGANISMS AROUND THE WORLD

BACKGROUND INFORMATION

- Classifying Biomes: Scientists map and classify biomes based on the dominant vegetation. That vegetation is determined by regional variations in climate and terrain. Here, the classification system is based on six biomes. Grassland and desert are familiar terms. Sometimes you hear of the "frozen tundra," which provides some idea of what to expect in that biome. Boreal forests (taiga) feature coniferous evergreen forests that grow where there is a moderate rain and winter temperatures are cold. Temperate forests lose their leaves in the fall and grow new ones each spring. Tropical rainforests can be found in regions near the equators, where the temperature is warm and there is a great deal of rain.
  - Tundra Biome: Tundra is a vast, treeless plain. The soil is frozen, and, for 9 months of the year, tundra lakes lay buried beneath a blanket of ice. Short summers bring long hours of daylight but little heat. Tundra areas are frozen deserts: very little snow falls. Winds constantly blow the snow around, giving the illusion that this region receives a great deal of snow.
  - The Boreal Forest (Taiga) Biome: This is a transition zone south of the tundra. Abiotic factors gradually change from north to south as the climate becomes warmer and wetter. The boreal forest receives more of the Sun's heat for a longer summer. The change in climate is accompanied by a gradual change in vegetation and animal life. Moving south, clumps of dwarf trees, scattered in sheltered areas, gradually increase in size and number. Further south, a distinct treeline is observed, marking the northern edge of the boreal (coniferous) forest.
  - Temperate Forest: The temperate deciduous forest biome usually begins on the southern edge of the boreal forest, with even more temperate (moderate) climate and abundant moisture that is evenly distributed throughout the year. The four seasons are well developed, and the temperature gradually changes with the seasons. The growing season ranges from 4 to 6 months.



Organisms around the World

Figure 8.8 shows the six major world biomes and a few of the plants and animals that are adapted to live there. The world is divided into major biomes, each with a particular set of environmental conditions. These conditions determine where organisms can survive and thrive.

Figure 8.8 World biomes and some of their characteristic organisms.

Tundra

Plants: Grasses, wildflowers, mosses, small shrubs

Animals: Musk ox, caribou, polar bears, Arctic foxes, weasels, owls, grouse, rodents, black flies, other insects

Location: Far north, such as the high Arctic region of Canada; also in high mountains

Climate: Very cold, long winters; short and cool summers; 10–25 cm of precipitation a year

Boreal Forest (Taiga)

Plants: Mostly spruce, fir, and other cone-bearing, evergreen trees

Animals: Rodents, snowshoe hares, moose, lynx, least weasels, caribou, black bears, grizzly bears, wolves, many birds

Location: Most of Canada, Russia, and Scandinavia (Sweden, Denmark, Norway)

Climate: Very cold winters, cool summers; about 50 cm of precipitation a year

Temperate Forest

Plants: Broad-leaved trees such as oak, beech, maple

Animals: Wolves, deer, bears, and a variety of small mammals, birds, amphibians, reptiles, and insects

Location: Most of the United States, United Kingdom, western Europe, Brazil, eastern China

Climate: Relatively mild summers and cold winters; usually have four distinct seasons; 75–150 cm of precipitation a year

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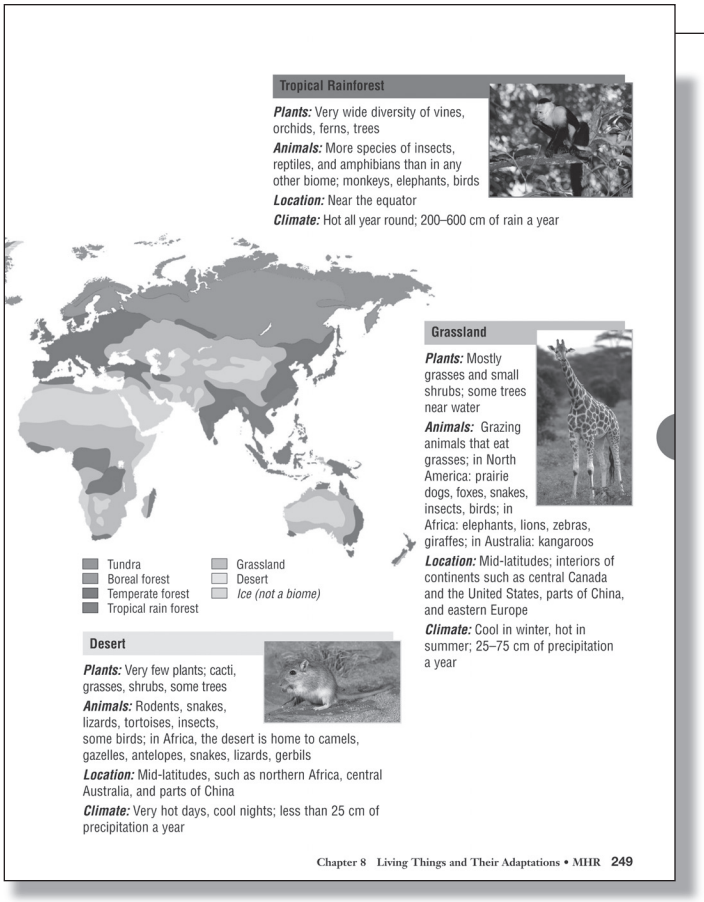
  - Grassland Biome: All of the world's grasslands have six things in common: rolling to flat terrain; a climax vegetation of grasses; low and irregular precipitation; a high rate of evaporation of soil moisture; occasional severe droughts; and an animal community dominated by burrowers and grazers. The intensity and duration of the sunlight the areas receive are about the same as in the temperate forest. The difference, however, is the low rainfall, which produces soil conditions that support grasses and crops rather than trees.
  - Tropical Rainforest: Tropical rainforests are close to the equator and are characterized by warm temperatures and a great deal of rain. Rainforests are home to more species of organisms than any other biome on Earth, possibly because they provide a multitude of habitats and niches for diverse organisms. In Canada, this biome is found on the west coast, in the Queen Charlotte Islands.



– Desert Biome: A desert is an arid region with sparse to almost non-existent plant life. The Atacama Desert in Chile receives an annual rainfall of less than 0.004 inches. With limited rainfall, vegetation in deserts varies greatly. Areas that receive more rainfall produce a shrub community that includes drought-resistant trees such as mesquite. Less rainfall results in scattered plant life and produces an environment with large areas of bare ground. The driest deserts are drifting sand dunes. Plants such as creosote and cacti have various adaptations for living in arid areas. Many desert plants are annuals that germinate from seed and grow to maturity quickly after sporadic rainfall. Cacti have leaves that are reduced to spines, photosynthetic stems, and thick waxy coatings—all adaptations that conserve water. The leaves of some desert plants curl up, or even drop off altogether, thus reducing water loss during the extremely dry spells. Spines, thorns, or poisons also are adaptations thought to discourage herbivores. Many desert mammals are small herbivores that remain under cover during the heat of the day, emerging at night to forage on plants. The kangaroo rat is a desert herbivore that does not have to drink water. These rodents obtain the water they need from the water found in their food.

TEACHING STRATEGIES

- If time permits, put your students into teams of two or three and have them research one biome in depth. They can build a diorama or some other representation of the plants and animals found in the biome and present this information to the rest of the class. Students could also create a claymation or a computer slide show presentation. They may wish to compare and contrast two biomes for their study.
- Make BLM 8.5, World Biomes into an overhead transparency and use this to help students visualize where each biome is located.
- Students with experience of other countries may be able to tell the class about plants and animals found in different biomes.
- Bring in a series of videos, DVDs, or computers connected to the Internet to bring discussions on these biomes to life for your students.
- Have students create an imaginary biome. Create conditions and imagine what type of imaginary animals or organisms would live there and what adaptations they would need to survive.

Common Misconception

- Students may think that the tundra is found in both the northern and southern hemispheres. Although a similar climate exists in the far southern hemisphere, north of the Antarctic icefields, no tundra biome occurs there. This is because oceans cover the area.

CHANGE IS NATURAL IN ALL BIOMES

BACKGROUND INFORMATION

- 10 000 years ago: The major features of the Nova Scotia landscape are the product of its long geological history. The minor features, such as the final rounding of surface features and sea-level changes, are the product of glacial activity. 10 000 years ago, Nova Scotia was recovering from a period of glaciation.
- Use the following background information on each animal to provide more information for Find Out Activity 8-G.
  - Trilobites were Palaeozoic marine arthropods. Trilobites would flourish and then die out suddenly when conditions changed. Few families survived devastating episodes of changing environments. They would thrive for generations and then be wiped by another relatively quick change in conditions.
  - The horseshoe crab is estimated to have inhabited the Earth for over 300 million years. Most scientists believe that horseshoe crabs are the closest living relative of the *trilobite*.
  - Ammonites are perhaps the most widely known fossil, possessing the typically ribbed spiral-form shell. These creatures lived in the seas between 240 and 65 million years ago, becoming extinct along with the dinosaurs. They belong to a group of predators known as cephalopods, which includes their living relatives the octopus, squid, cuttlefish, and nautilus.
  - *Nautilus* is one of the last living genera of externally shelled cephalopods. These slow-moving organisms are considered primitive. In addition to having an external shell, these cephalopods do not have lenses in their eyes. The external shell of these animals provides both protection and rigid open spaces that can be filled with gas for buoyancy.

Figure 8.8 Up until about 10 000 years ago, a sheet of ice and snow up to 3 km thick covered half of Canada. Before it started to melt, this frozen sheet covered all of Canada and even part of the United States!

Change is Natural in all Biomes

Imagine travelling back in time to see your province 10 000 years ago. At that time, about half of Canada was covered in a huge sheet of ice like the one shown in Figure 8.8. A few thousand years earlier, ice had covered Nova Scotia and the other Atlantic provinces, too. Once the ice melted, the climate was still colder and drier than it is today. In fact, 10 000 years ago, Nova Scotia would have been part of the tundra biome.

Pause& Reflect

What do you think the landscape of Nova Scotia looked like 10 000 years ago? What kinds of plants and animals would you see? How would the plants and animals be adapted for their colder, drier environment?

Now imagine travelling farther back in time to see your province 100 000 000 years ago. At that time, North America was located farther south than it is today, so Nova Scotia was closer to the equator. The climate was much hotter and more humid than it is today. Nova Scotia might have been part of a tropical biome 100 000 000 years ago.

Pause& Reflect

What do you think the landscape of Nova Scotia looked like 100 000 000 years ago? What kinds of plants and animals would you see? How would the plants and animals be adapted for their warmer, more humid environment?

Throughout history, there has been a great diversity of life on Earth. Ten thousand years ago, one hundred million years ago, and even half a billion years ago, there were animals, plants, fungi, protists, bacteria, and archeans on Earth. However, many of the species that lived long ago do not exist today. They became **extinct**, which means that all the members of each species everywhere in the world died out completely. What can cause some species to become extinct but not others? You will think about answers to this question in the activity.

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TEACHING STRATEGIES

- Have students look closely at a world map and try to see if there is a jigsaw effect with the continents. Can they see how they might fit together?
- Use multimedia resources available to help students visualize the plants and animals of the Cretaceous Era, as well as what North America looked like during and after the last ice age.
- If you get the opportunity, take your students to the new Joggins Fossil Institute in Northern Cumberland County, Nova Scotia. Alternatively, access their web site by searching for "Joggins Fossil Cliffs."

Common Misconception

- Students may believe that only human activity creates climate change. Climate change is a natural phenomenon. For example, in the last 100 000 years, there have been approximately 16 ice ages that have affected North America. However, most scientists believe that the continued burning of fossil fuels is having a warming effect and accelerating climate change on Earth.

Find Out ACTIVITY 8–G

Changes in Organisms over Time

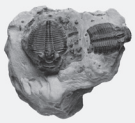
About 40 000 000 years ago, North America was home to animals that might surprise you—such as camels! By about 10 000 years ago, all of North America's camels went extinct. We know about them from their fossils. Fossils are the traces and remains of ancient organisms that have been preserved in rock for thousands or millions of years.

What to Do

1. Examine the photos and captions. Then answer the questions that follow.

What Did You Find Out?

1. What phylum did the trilobites belong to? (Refer to Figure 7.14 in Chapter 7).
2. To which phylum do you think horseshoe crabs belong?
3. Nautiluses are related to the extinct ammonites. To which phylum do nautiluses belong?
4. An extreme event happened 65 000 000 years ago that caused many species from all six kingdoms to become extinct.
   (a) Use what you know about adaptations to give a reason why ammonites, dinosaurs, and other organisms went extinct.
   (b) Use what you know about adaptations to give a reason why some species, such as horseshoe crabs and nautiluses, did not become extinct.



A About 500 000 000 years ago, Earth's oceans were teeming with organisms called trilobites. Trilobites were arthropods. By about 265 000 000 years ago, trilobites had become extinct.

B Horseshoe crabs appeared on Earth around when trilobites did. Although they are called crabs, horseshoe crabs are more closely related to spiders and the extinct trilobite.

C Ammonites were ocean-dwellers that appeared about 250 000 000 years ago. They were members of the mollusc phylum. Ammonites went extinct 65 000 000 years ago.

D Nautiluses first appeared on Earth around when ammonites did. There are still several species of nautilus alive today, but most are extinct.

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Pause & Reflect Data from pollen analysis of peat bogs suggest that tundra conditions still prevailed 10 000 years ago. As more soil built up and the climate became more temperate, grasses, sedges and ferns, club mosses and horsetails became common. Later, populations of trees such as poplars, then birches, fir, spruce, and pines increased in abundance. As the area became warmer and wetter, organisms suited to dry, cold areas would likely die out and organisms better suited to the new conditions would move in. If the change in conditions was gradual enough, it is possible that some populations would adapt.

Pause & Reflect 100 000 000 years ago, Nova Scotia may have looked like a relatively uniform, flat plain almost at sea level. This plain extended from New Brunswick to beyond the present coastline and over at least part of today's continental shelf. Erosion occurred in the form of wind abrasion and flash flooding. The climate was mostly hot and probably moist. Flowering plants would have appeared first, including various grains and grasses. Insects continued to evolve and help pollinate the flowers. The earliest evidence of snakes (descended from earlier reptiles) is from this period. Dinosaurs ruled Earth until the end of the Cretaceous Period, when a major event signalled both the end of the Cretaceous Period and the end of the Mesozoic Era.

FIND OUT ACTIVITY 8-G CHANGES IN ORGANISMS OVER TIME

Purpose

- Students use fossil evidence to support the idea that life on Earth has changed through the ages.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	– Photocopy BLM 8.6, Changes in Organisms over Time or make it into an overhead.

Suggested Time

- 30 min

TIPS & HINTS

- Use a computer connected to the Internet and an LCD projector to project images of these animals on the screen.
- Bring in a crab, lobster, squid, or octopus to point out the connections to these animals. Note that the horseshoe crab is not a crab. However, you can point out the jointed appendages that put it in the same phyla as the crabs and lobsters.

Implementing the Activity

- Use BLM 8.6, Changes in Organisms over Time to provide larger images of the four organisms shown in this activity.
- Encourage students to compare and contrast the ancient and modern organisms.

Adaptation

- Reading the questions to your students could help students with ESL or reading problems.

Activity Wrap-Up

- Discuss the answers to the *What Did You Find Out?* questions with your students.

What Did You Find Out? Answers

1. Trilobites belong to the arthropod phylum (jointed appendages).
2. Horseshoe crabs belong to the arthropod phylum (jointed appendages).
3. Nautiluses belong to the mollusc phylum.
4. (a) Climate conditions changed, sea levels changed, and perhaps a large meteorite struck Earth. Whatever happened, many species of plants and animals did not have the adaptations to survive these changes and they died.
   (b) Horseshoe crabs and nautiluses must have had the adaptations necessary to survive the changes.

CONSIDERING CONSEQUENCES

BACKGROUND INFORMATION

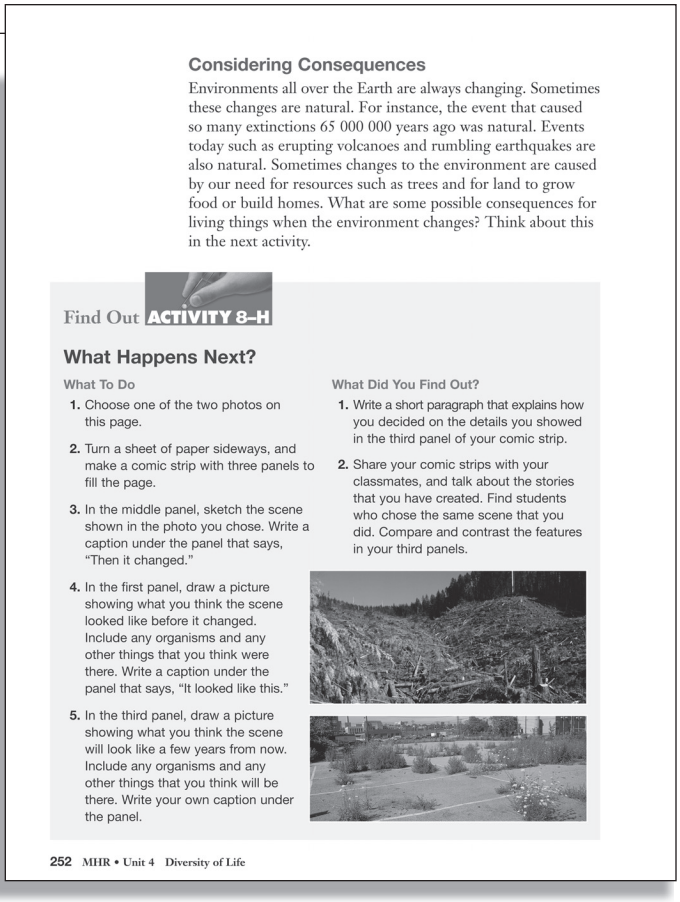
- The extinction discussed in the textbook occurred about 65 million years ago and was probably caused or aggravated by the impact of a several-miles-wide asteroid that created the Chicxulub crater now hidden beneath the Gulf of Mexico. Some scientists argue for other causes, including gradual climate change or flood-like volcanic eruptions of basalt lava from India's Deccan Traps. The extinction killed 16 percent of marine families, 47 percent of marine genera (the classification above species), and 18 percent of land vertebrate families, including the dinosaurs. At least four other mass extinctions are known: End-Triassic extinction, roughly 199 million to 214 million years ago; Permian-Triassic extinction, about 251 million years ago; late Devonian extinction, about 364 million years ago; and the Ordovician-Silurian extinction, about 439 million years ago.

TEACHING STRATEGIES

- Use examples from your part of the province, such as abandoned farmsteads or parking lots, to help students visualize what will happen if the area is left undisturbed for many years. If possible, take students to a specific area to observe it now, and maybe sketch out what it looks like. Group students in teams of four, and ask them to develop sketches of 10 years and 20 years later.
- The History Channel has an interactive web site with segments of a video called "Life After People," which speculates on how Earth would change if there were no humans. It speculates that human life disappears after a major disaster, and the doomsday scenario may not be suitable for all students. The book *The World Without Us*, by Alan Weisman discusses the same topic without the doomsday scenario. A video presentation entitled The World Without US is a political piece speculating on the world scene if the U.S. was no longer a dominant force and is not relevant to this topic.

Common Misconception

- Students may think that all extinctions are the direct result of human activities. Although it is true that humans have been directly responsible for the extinction of many species, natural causes as discussed previously have accounted for the extinction of many hundreds of thousands of species.



Considering Consequences

Environments all over the Earth are always changing. Sometimes these changes are natural. For instance, the event that caused so many extinctions 65 000 000 years ago was natural. Events today such as erupting volcanoes and rumbling earthquakes are also natural. Sometimes changes to the environment are caused by our need for resources such as trees and for land to grow food or build homes. What are some possible consequences for living things when the environment changes? Think about this in the next activity.

Find Out ACTIVITY 8–H

What Happens Next?

What To Do

1. Choose one of the two photos on this page.
2. Turn a sheet of paper sideways, and make a comic strip with three panels to fill the page.
3. In the middle panel, sketch the scene shown in the photo you chose. Write a caption under the panel that says, "Then it changed."
4. In the first panel, draw a picture showing what you think the scene looked like before it changed. Include any organisms and any other things that you think were there. Write a caption under the panel that says, "It looked like this."
5. In the third panel, draw a picture showing what you think the scene will look like a few years from now. Include any organisms and any other things that you think will be there. Write your own caption under the panel.

What Did You Find Out?

1. Write a short paragraph that explains how you decided on the details you showed in the third panel of your comic strip.
2. Share your comic strips with your classmates, and talk about the stories that you have created. Find students who chose the same scene that you did. Compare and contrast the features in your third panels.

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FIND OUT ACTIVITY 8-H WHAT HAPPENS NEXT?

Purpose

- Students infer what changes will take place in the two areas shown if left undisturbed for many years.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	– Take students to an area that has been disturbed by human activity (abandoned parking lot, rail line, farm).

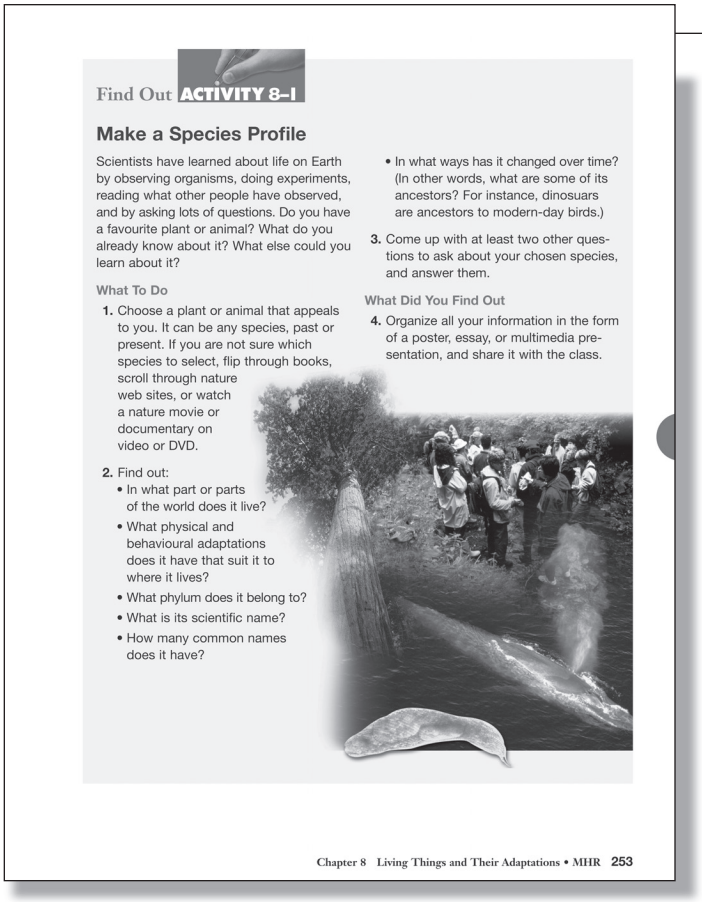
MATERIALS
– paper – pencils, crayons, markers – ruler or straight edge

Suggested Time

- 30 min to draw their comic strip
- 30 min to share their comic strips with classmates

HINTS & HELPS

- If possible, arrange to take your students on a short walk to an abandoned parking lot, rail line, clear cut area, or farm. They should be able to see evidence of change.
- Obtain digital images of an abandoned parking lot, rail line, clear cut area, or farm in your locality. Project these images and have your students discuss evidence of change in the area.



Find Out ACTIVITY 8–I

Make a Species Profile

Scientists have learned about life on Earth by observing organisms, doing experiments, reading what other people have observed, and by asking lots of questions. Do you have a favourite plant or animal? What do you already know about it? What else could you learn about it?

What To Do

1. Choose a plant or animal that appeals to you. It can be any species, past or present. If you are not sure which species to select, flip through books, scroll through nature web sites, or watch a nature movie or documentary on video or DVD.
2. Find out:
   - In what part or parts of the world does it live?
   - What physical and behavioural adaptations does it have that suit it to where it lives?
   - What phylum does it belong to?
   - What is its scientific name?
   - How many common names does it have?
   - In what ways has it changed over time? (In other words, what are some of its ancestors? For instance, dinosaurs are ancestors to modern-day birds.)
3. Come up with at least two other questions to ask about your chosen species, and answer them.

What Did You Find Out

4. Organize all your information in the form of a poster, essay, or multimedia presentation, and share it with the class.

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Implementing the Activity

- Students should be able to imagine what the scene looked like before the logging and paving based on clues in the photos. Encourage them to study the surrounding area.

Adaptation

- Group students to ensure all have an opportunity for success. Some students may prefer to sketch a story of succession and make an audio recording to accompany the pictures.

Activity Wrap-Up

- Have students discuss the paragraph that they wrote to answer *What Did You Find Out?* question 1.

Assessment Option

- Use Science Skills Checklist 15, Making Observations and Inferences to assess students' work.

What Did You Find Out? Answers

1. The third panel will be speculative, however it should reflect some continuity with what they believe came before and what they see in the photo. The change they reflect should not be radical because there is no suggestion that climate conditions are going to change dramatically.

FIND OUT ACTIVITY 8-I MAKE A SPECIES PROFILE

Purpose

- Students research and present a species and its adaptations to its environment.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
3 to 4 weeks before	– Book library.
1 day before	– Photocopy Learning Skills Rubric 5, Research Project or selected Checklists (optional).

MATERIALS
– print and/or digital resources – poster paper, multimedia enabled computers as appropriate

Suggested Time

- 30 min to do their research
- 45 min to write their script

HINTS & TIPS

- To save time, put the names of a number of plant and animal species on small pieces of paper and have each student draw one. Match the species to the resources available.
- Have a number of appropriate web sites bookmarked.
- Distribute Learning Skills Rubric 5, Research Project to give students an idea of how to conduct research effectively.

Implementing the Activity

- This activity could serve as an opportunity to teach students how to make a multimedia presentation. Consider working with the librarian, art teacher, language arts teacher, and/or computer teacher to make this an interdisciplinary activity.
- As an alternative, the assignment could take the form of writing a script for radio or television. The "spot" would only take one minute and would present the species to the public. Students can suggest camera shots and/or sound effects.

Activity Wrap-Up

- Have students share their presentations.

Assessment Options

- Use one of the following Learning Checklists: 3, Oral Presentation; 4, Computer Slide Show Presentation; or 5, Poster to assess students' work.

What Did You Find Out? Answers

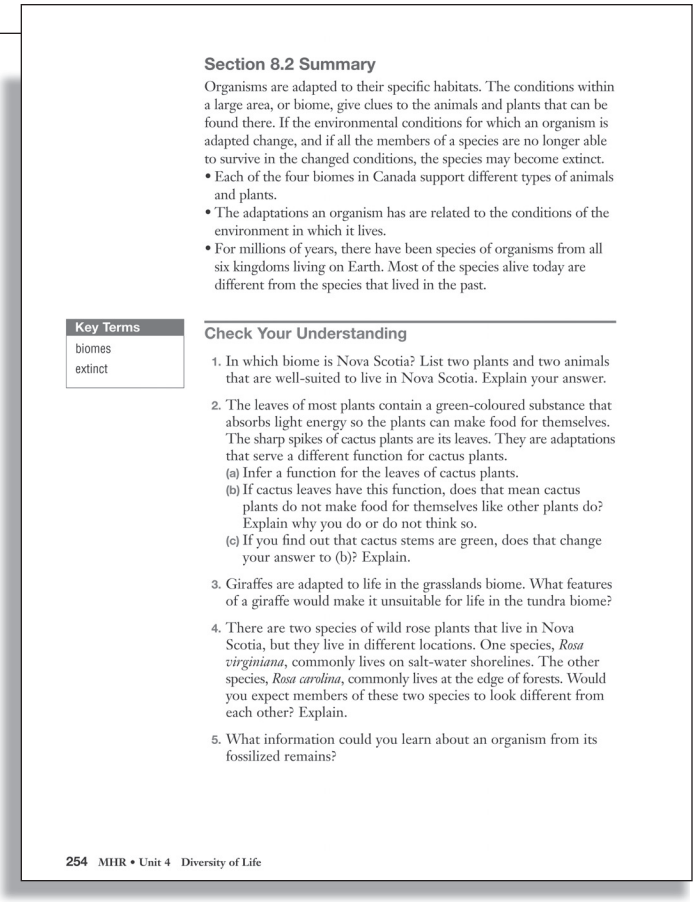
1. Student work should be organized with headings or other appropriate signalling features and present the required information. The two new questions should reflect other aspects of the unit.

SECTION 8.2 SUMMARY

Review the section summary as a class. Make sure that students update their logbooks and key terms list. Have students share some of their definitions of the key terms with the class and compare different interpretations of the same words.

✓ ASSESSMENT OPTIONS FOR SECTION 8.2

- Collect and review science logbooks, using Learning Skills Rubric 2, Science Logbook to evaluate student work.
- Use the following rubrics and checklists to assess student work:
  - Process Skills Rubric 14, Predicting for Find Out Activity 8-E: Where in the World?
  - Learning Skills Rubric 3, Co-operative Group Work for Find Out Activity 8-F: Checking Out the Neighbourhood
  - Discuss the *What Did You Find Out?* questions for Find Out Activity 8-G: Changes in Organisms over Time to assess student understanding of gradual change.
  - Science Skills Checklist 15, Making Observations and Inferences for Find Out Activity 8-H: What Happens Next?
  - Learning Checklist 3, Oral Presentation; Learning Checklist 4, Computer Slide Show Presentation; or Learning Checklist 5, Poster for Find Out Activity 8-I: Make a Species Profile



Section 8.2 Summary

Organisms are adapted to their specific habitats. The conditions within a large area, or biome, give clues to the animals and plants that can be found there. If the environmental conditions for which an organism is adapted change, and if all the members of a species are no longer able to survive in the changed conditions, the species may become extinct.

- Each of the four biomes in Canada support different types of animals and plants.
- The adaptations an organism has are related to the conditions of the environment in which it lives.
- For millions of years, there have been species of organisms from all six kingdoms living on Earth. Most of the species alive today are different from the species that lived in the past.

Key Terms

biomes
extinct

Check Your Understanding

1. In which biome is Nova Scotia? List two plants and two animals that are well-suited to live in Nova Scotia. Explain your answer.
2. The leaves of most plants contain a green-coloured substance that absorbs light energy so the plants can make food for themselves. The sharp spikes of cactus plants are its leaves. They are adaptations that serve a different function for cactus plants.
   (a) Infer a function for the leaves of cactus plants.
   (b) If cactus leaves have this function, does that mean cactus plants do not make food for themselves like other plants do? Explain why you do or do not think so.
   (c) If you find out that cactus stems are green, does that change your answer to (b)? Explain.
3. Giraffes are adapted to life in the grasslands biome. What features of a giraffe would make it unsuitable for life in the tundra biome?
4. There are two species of wild rose plants that live in Nova Scotia, but they live in different locations. One species, *Rosa virginiana*, commonly lives on salt-water shorelines. The other species, *Rosa carolina*, commonly lives at the edge of forests. Would you expect members of these two species to look different from each other? Explain.
5. What information could you learn about an organism from its fossilized remains?

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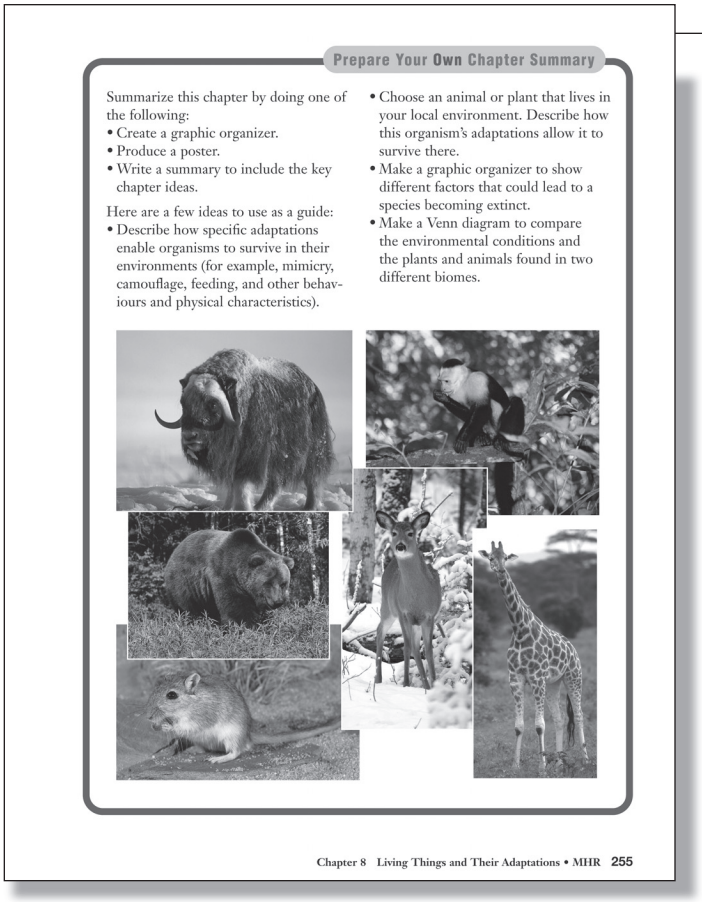
Check Your Understanding Answers

1. Nova Scotia is in the temperate deciduous forest biome. Accept any two plants such as red spruce, balsam fir, yellow birch, sugar maple, pin cherry, willow, speckled alder, steeplebush, and blueberry. Accept any two animals such as white-tailed deer, moose, black bear, raccoon, striped skunk, bobcat, and eastern chipmunk; whip-poor-will, blue jay, eastern bluebird, and rose-breasted grosbeak, great and double-crested cormorant, Atlantic puffin, common and thick-billed murre, black guillemot, and razorbill; seal, killer whale and northern bottlenosed whale. Explanations should reflect a thoughtful connection between features of the organism and the characteristics of the biome.
2. (a) The leaves of a cactus are likely best at keeping plant-eating animals (herbivores) away from the cactus. Also accept suggestions that the leaves of plants lose a great deal of water and by reducing the size of their leaves to needles, the cactus reduces the amount of water it loses.


Prepare Your Own Chapter Summary

Summarize this chapter by doing one of the following:
- Create a graphic organizer.
- Produce a poster.
- Write a summary to include the key chapter ideas.

Here are a few ideas to use as a guide:
- Describe how specific adaptations enable organisms to survive in their environments (for example, mimicry, camouflage, feeding, and other behaviours and physical characteristics).
- Choose an animal or plant that lives in your local environment. Describe how this organism's adaptations allow it to survive there.
- Make a graphic organizer to show different factors that could lead to a species becoming extinct.
- Make a Venn diagram to compare the environmental conditions and the plants and animals found in two different biomes.

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(b) Students could infer that the leaves do not make food. The photosynthesizing pigments are in the stem, which is where the cactus makes its food.

(c) Yes, because that would mean that there were photosynthesizing pigments in the leaves and they could make food for the plant.

3. The long neck and ears and thin fur would lose a great deal of heat, making it impossible for this animal to survive the cold temperatures. The giraffe also needs a great deal of grass to keep it alive. It would not be able to survive on the sparse vegetation found in the tundra.
4. Although they are members of the same genus, they are different species. I would expect them to have some characteristics in common, but other characteristics would be different because they are two different species, adapted to two different environments.
5. Fossils provide information about the climatic conditions in the distant past and the plants, animals, and habitat at different times in Earth's history.

Prepare Your Own Chapter Summary

Student summaries should incorporate the following main ideas:

- adaptations are inherited characteristics
- adaptations happen to populations over long periods of time
- physical adaptations are features of structure or appearance that give organisms a better chance of surviving in their surroundings
- camouflage refers to physical adaptations that help organisms hide from other organisms
- mimicry is a type of camouflage; it allows organisms to gain protection by copying coloration and/or shape of other organisms or objects
- behavioural adaptations are habits and activities of organisms that are important for survival; hibernation and migration are examples of behavioural adaptations
- each of the four biomes in Canada support different types of animals and plants
- the adaptations an organism has are related to the conditions of the environment in which it lives. (This idea can be explored when developing imaginary biomes and organisms.)
- most of the species alive today are different from the species that lived in the past; what might they look like in the future?

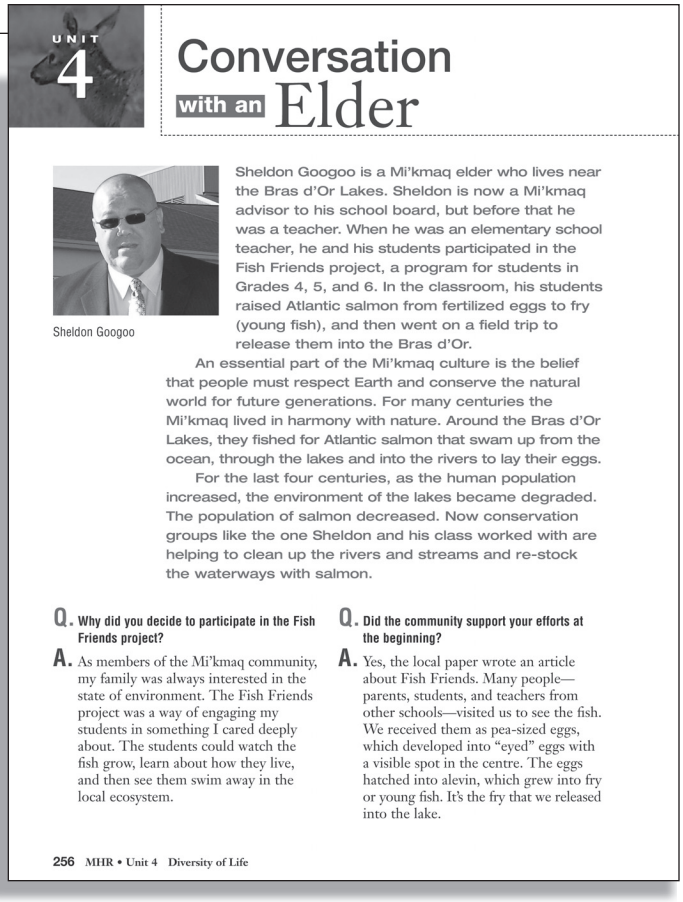
CONVERSATION WITH AN ELDER SHELDON GOOGOO

BACKGROUND INFORMATION

- The Mi'kmaq are the only Nova Scotia First Nation. Their traditional territory, Mi'kma'ki, includes all of Nova Scotia and Prince Edward Island and parts of New Brunswick, Newfoundland and Labrador, Quebec (Gaspe Peninsula), and New England (coast of Maine).
- The Atlantic Salmon Federation, in co-operation with the Nova Scotia Salmon Association and its affiliate network, delivers its Fish Friends Educational Programs to students in grades 4, 5, and 6. Students learn about the life of salmon and other aquatic creatures in marine and freshwater ecosystems. Activities teach youngsters important conservation and environmental lessons in a hands-on classroom setting.

TEACHING STRATEGIES

- Read the Conversation with an Elder (pp. 256 and 257) with your students.
- Invite a local Mi'kmaq representative to assist in explaining the program.



UNIT 4

Conversation with an Elder

Sheldon Googoo

Sheldon Googoo is a Mi'kmaq elder who lives near the Bras d'Or Lakes. Sheldon is now a Mi'kmaq advisor to his school board, but before that he was a teacher. When he was an elementary school teacher, he and his students participated in the Fish Friends project, a program for students in Grades 4, 5, and 6. In the classroom, his students raised Atlantic salmon from fertilized eggs to fry (young fish), and then went on a field trip to release them into the Bras d'Or.

An essential part of the Mi'kmaq culture is the belief that people must respect Earth and conserve the natural world for future generations. For many centuries the Mi'kmaq lived in harmony with nature. Around the Bras d'Or Lakes, they fished for Atlantic salmon that swam up from the ocean, through the lakes and into the rivers to lay their eggs.

For the last four centuries, as the human population increased, the environment of the lakes became degraded. The population of salmon decreased. Now conservation groups like the one Sheldon and his class worked with are helping to clean up the rivers and streams and re-stock the waterways with salmon.

Q. **Why did you decide to participate in the Fish Friends project?**

A. As members of the Mi'kmaq community, my family was always interested in the state of environment. The Fish Friends project was a way of engaging my students in something I cared deeply about. The students could watch the fish grow, learn about how they live, and then see them swim away in the local ecosystem.

Q. **Did the community support your efforts at the beginning?**

A. Yes, the local paper wrote an article about Fish Friends. Many people—parents, students, and teachers from other schools—visited us to see the fish. We received them as pea-sized eggs, which developed into "eyed" eggs with a visible spot in the centre. The eggs hatched into alevin, which grew into fry or young fish. It's the fry that we released into the lake.

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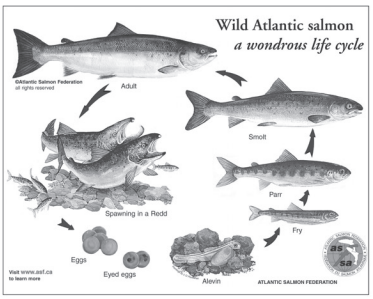


After they are released, the salmon fry grow into parr. Parr, which are well-camouflaged, live in the river or lake for two to eight years. When they are 12 to 24 cm long, parr transform into smolt. The smolt swim down the river and out into the ocean. This migration to and from ocean feeding grounds may be a trip of more than 4000 km. After one or more years, the adult salmon swim back up the rivers and lakes. Females use their tails to dig a nest or "redd" in a stream bottom. Then the males and females spawn, producing fertilized eggs.

Q. What did your students think about the project?

A. They loved it! They were just as excited at the end of the project as they were at the beginning.

Q. Why were the Bras d'Or Lakes chosen as the release site?

A. The idea came from the co-ordinator of Fish Friends. He had identified this as one of the endangered areas, with a low fish population. We went on a bus to the release site. Each student had a bag of fish and was responsible for the safe release of those fish.

Q. How did the students feel after the release?

A. They had become fond of their fish, and some students cried many nights after the release. Former students still come up to me today and remember the experience of the Fish Friends project.

Q. Was the community supportive through the whole project?

A. Reporters from the local paper were there on the day of the release, and they published a follow-up story. Since then, many other schools have participated in a Fish Friends project. I think everyone became more aware of the importance of nature and of how all living things are connected in the web of life.

EXPLORING Further

Find out more about the Fish Friends project at **www.mcgrawhill.ca/links/ns+science6**. Follow the links to download the *Volunteer Primer* that explains the program, and discuss it with a friend or family member who might be interested in becoming a volunteer at your school. Write a proposal to recruit a volunteer, and explain to your teacher or school principal how your school could participate in the program.

EXPLORING FURTHER

Purpose

- Students write a proposal to recruit a Fish Friends volunteer and explain the Fish Friends program to the school's principal.

NOTE: This activity is not structured to actually implement the Fish Friends program in your class. Students may choose to look at another organization.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 day before	– Download and print the Volunteer Primer from the Fish Friends web site.

MATERIALS
– none required for the Exploring Further activity as written – additional materials will be required if you implement the Fish Friends program in your classroom. Visit the Fish Friends web site for information

Suggested Time

- 15 min to research Fish Friends
- 30 min to outline the steps required for a proposal and then write the proposal

HINTS & TIPS

- Contact an Atlantic Salmon Federation (ASF) employee or volunteer in your area and invite them to come into your classroom to discuss the project with your students.
- Use the information on the ASF web site to contact a teacher involved in this program. Ask this individual for advice on how to successfully implement this project in your classroom.
- Use a literacy lesson to discuss how to write a letter of persuasion.

Implementing the Activity

- Follow the instructions to download the *Volunteer Primer* booklet. Photocopy and distribute this booklet to your students. Have your students write a proposal to recruit a volunteer and which also explains this program to the principal.
- Provide your students with an outline of what you think should go into their proposal.

Activity Wrap-Up

- Present the proposal to a potential volunteer and the principal of the school.
- Implement Fish Friends in your classroom and wrap it up with the release of Atlantic salmon fry into an approved stream near your school.

CONVERSATION WITH ELDERS PATRICK AND ELEANOR JOHNSON

BACKGROUND INFORMATION

- The Mi'kmaq people have an oral tradition. Their Mi'kmaw language is part of the Algonquian language family. The language in its written form is a recent development.
- The number of children learning the language has been in decline in recent years. The Mi'kmaq people are working to reverse this trend because language is an integral part of culture.

TEACHING STRATEGIES

- Read this feature with your students.

Conversation with Elders

Patrick and Eleanor Johnson

Patrick and Eleanor Johnson are Elders in the Membertou community in Sydney. They work at the Mi'kmaq College Institute at the University of Cape Breton, which they helped found. They also helped develop courses that support the achievements of Mi'kmaq communities. Eleanor continues to teach at the College. Patrick is the Director of Mi'kmaq Student Services.

For Patrick and Eleanor Johnson, Mi'kmaq is their first language. Their parents and grandparents spoke Mi'kmaq to them as they were growing up but also taught them English so they would be comfortable in school. Eleanor was able to use both English and Mi'kmaq in her studies. While studying for her second degree, a Master's degree at Saint Mary's University in Halifax, she was the first person in North America to submit a thesis written in an aboriginal language.

Q. What relationship do the Mi'kmaq people have with the environment that supports them?

A. We are part of the environment. In our communities we do not have direct ownership of the land we live on. We are given a space in our community where we can put our home, but the land it sits on is owned by the First Nation Community. In the past, a family would occupy enough land to sustain themselves. If the land was not able to provide enough for them to be comfortable, then the family would ask permission of the District Chief to move elsewhere.

Q. What knowledge did the Mi'kmaq have that helped them survive on their lands?

A. The Mi'kmaq had an intimate knowledge of the land and the weather. They knew what resources there were and how to use them to provide themselves with food and shelter.

Q. How do the Mi'kmaq show respect for their environment?

A. We feel reverence for the land and the creatures that are on the land. For example, hunters gave thanks to the animal that allowed itself to be killed for food. They would make an offering or say a prayer to thank the animal for providing the community with food, clothing, and tools.

There is a ceremony that some of our Elders do on February 1 to *Apukanajit*, the winter spirit that controls the elements. They make an offering to the spirit of *Apukanajit*, asking that they stay warm and not freeze during the winter, and have enough clothing and food. They also entreat the spirit of *Apukanajit* to protect them and all who travel during the remaining winter months.

Q. How are young people taught to become good caretakers of their environment?

A. The role of young people is to learn their language. As they do that, they will learn to have respect for the land and the environment that they are part of. We are part of a collective, not just of Mi'kmaki, but also of the whole world.

Q. Do you talk with your grandchildren in Mi'kmaq?

A. Yes. We were both brought up speaking Mi'kmaq. That was the language we used at home and how we communicated with our parents and relatives. Our children have continued this tradition, and now our grandchildren have their first two years of instruction in Mi'kmaq at the Eskasoni Immersion school. The language is integral to our culture, traditions, and history. Our grandchildren are our future, and the language is so integral to our culture, traditions, and history that we make sure we speak it all the time. Sometimes, if one of our grandchildren persists in speaking English, we pretend to be deaf. We only answer if they speak in Mi'kmaq.

Q. What is the most important part of your culture to pass along to your children and grandchildren?

A. Everyone should have respect for all creatures, from the tiniest ant to the most gigantic whale. We should recognize how the environment affects everything we do. We are not the rulers of the environment. We are only a presence in it.

EXPLORING Further

In communities across Canada, people are waking up to the importance of the environment. In cities, volunteers plant trees. In towns and rural areas, people are cleaning up the sides of highways, or helping to restock rivers and lakes with fish. Aboriginal cultures have a strong sense of community, but anyone anywhere can feel connected to the environment and to others. Volunteer organizations can help you be part of the community.

Go to **www.mcgrawhill.ca/links/ns+science6**. Follow the links to find information about dozens of volunteer organizations in Nova Scotia. Select either one from the information you find or another one that you know about in your community. Find out what their volunteers do, and what opportunities there are for you to become involved. Report back to your class about opportunities that interest you in a form suggested by your teacher.

EXPLORING FURTHER

Purpose

- Students investigate volunteer organizations in Nova Scotia.

Advance Preparation

None

Suggested Time

- 30 min to research volunteer organizations
- 30 min to present information to rest of class

TEACHER'S HELPS

- Bookmark specific web sites that identify appropriate volunteer activities for your students.
- Contact suitable volunteer agencies in your community and have them come into your class to discuss their programs.

Implementing the Activity

- Focus student searches to grade-level appropriate volunteer activities.
- Establish the format for student presentations on the roles of volunteers in their chosen organization and what opportunities students could take part in.
- Encourage students to do some writing about their thoughts on volunteer work.

Activity Wrap-Up

- Students present their findings to the rest of the class.

UNIT 4 PROJECT DESIGN A PLANT FOR ITS HABITAT

Purpose

- Students use their problem-solving skills to design a plant that could survive in an extremely harsh environment.

Advance Preparation

WHEN TO BEGIN	WHAT TO DO
1 week before	– Organize the supplies required for this project.
1 day before	– Photocopy Learning Skills Checklist 11, Project Self Assessment and Learning Skills Checklist 12, Project Group Assessment.

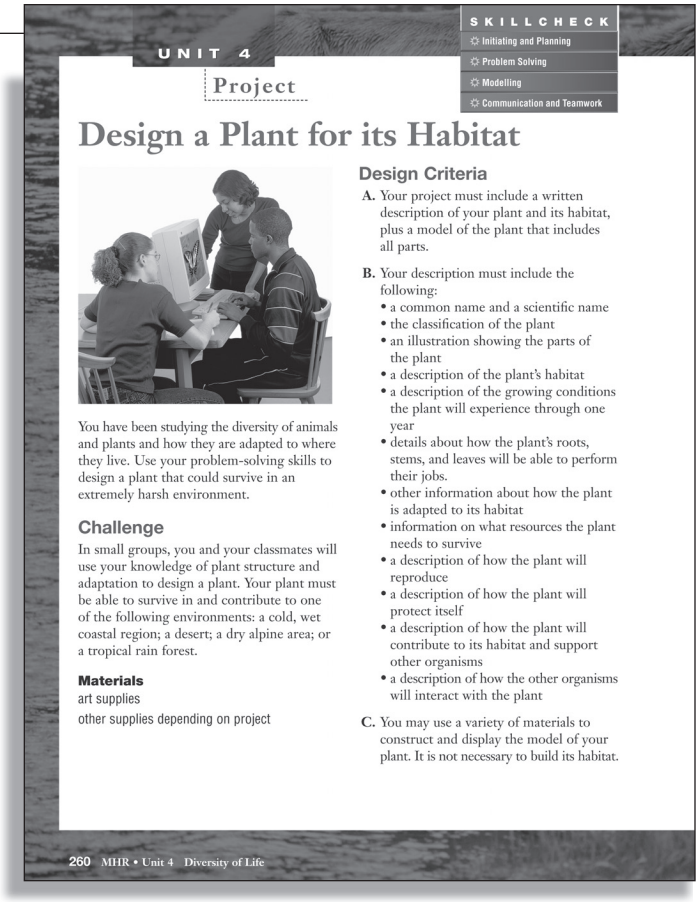
MATERIALS
– art supplies – other supplies depending on project

Suggested Time

- 45–60 min to plan and write up the project description
- 90 min to construct their plant
- 30 min to present their findings

HINTS & HELPS

- Try to limit the amount of time students spend in the planning stage.



UNIT 4

Project

SKILLCHECK
- Initiating and Planning
- Problem Solving
- Modelling
- Communication and Teamwork

Design a Plant for its Habitat

You have been studying the diversity of animals and plants and how they are adapted to where they live. Use your problem-solving skills to design a plant that could survive in an extremely harsh environment.

Challenge

In small groups, you and your classmates will use your knowledge of plant structure and adaptation to design a plant. Your plant must be able to survive in and contribute to one of the following environments: a cold, wet coastal region; a desert; a dry alpine area; or a tropical rain forest.

Materials

art supplies

other supplies depending on project

Design Criteria

A. Your project must include a written description of your plant and its habitat, plus a model of the plant that includes all parts.

B. Your description must include the following:
- a common name and a scientific name
- the classification of the plant
- an illustration showing the parts of the plant
- a description of the plant's habitat
- a description of the growing conditions the plant will experience through one year
- details about how the plant's roots, stems, and leaves will be able to perform their jobs.
- other information about how the plant is adapted to its habitat
- information on what resources the plant needs to survive
- a description of how the plant will reproduce
- a description of how the plant will protect itself
- a description of how the plant will contribute to its habitat and support other organisms
- a description of how the other organisms will interact with the plant

C. You may use a variety of materials to construct and display the model of your plant. It is not necessary to build its habitat.

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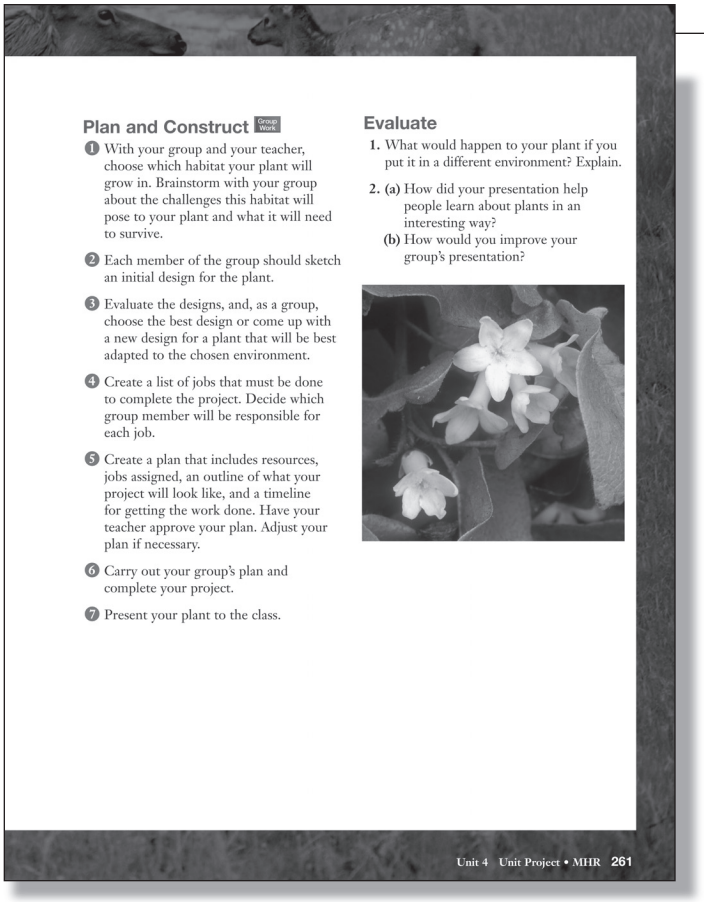

Plan and Construct Group Work

1. With your group and your teacher, choose which habitat your plant will grow in. Brainstorm with your group about the challenges this habitat will pose to your plant and what it will need to survive.
2. Each member of the group should sketch an initial design for the plant.
3. Evaluate the designs, and, as a group, choose the best design or come up with a new design for a plant that will be best adapted to the chosen environment.
4. Create a list of jobs that must be done to complete the project. Decide which group member will be responsible for each job.
5. Create a plan that includes resources, jobs assigned, an outline of what your project will look like, and a timeline for getting the work done. Have your teacher approve your plan. Adjust your plan if necessary.
6. Carry out your group's plan and complete your project.
7. Present your plant to the class.

Evaluate

1. What would happen to your plant if you put it in a different environment? Explain.
2. **(a)** How did your presentation help people learn about plants in an interesting way?
   (b) How would you improve your group's presentation?

Implementing the Project

- Photocopy and distribute any assessment rubrics or checklists that you are going to use to evaluate this project.
- Clearly outline the rules, procedures, and your expectations for students and parents.
- Suggest that students follow the list in Design Criteria B when creating their written description.

Adaptation

- Team students according to abilities.

Project Wrap-Up

- Students present their plant to the rest of the class.

Evaluate Answers

1. The plant would likely have problems growing and could die. Plants have specific adaptations for specific environments. Moving a plant to a different environment would put the plant under stress. The plant would not likely grow as well and could possibly die.
2. (a) and (b) Students' answers should show an awareness of what they intended to communicate as well as their audience's response.